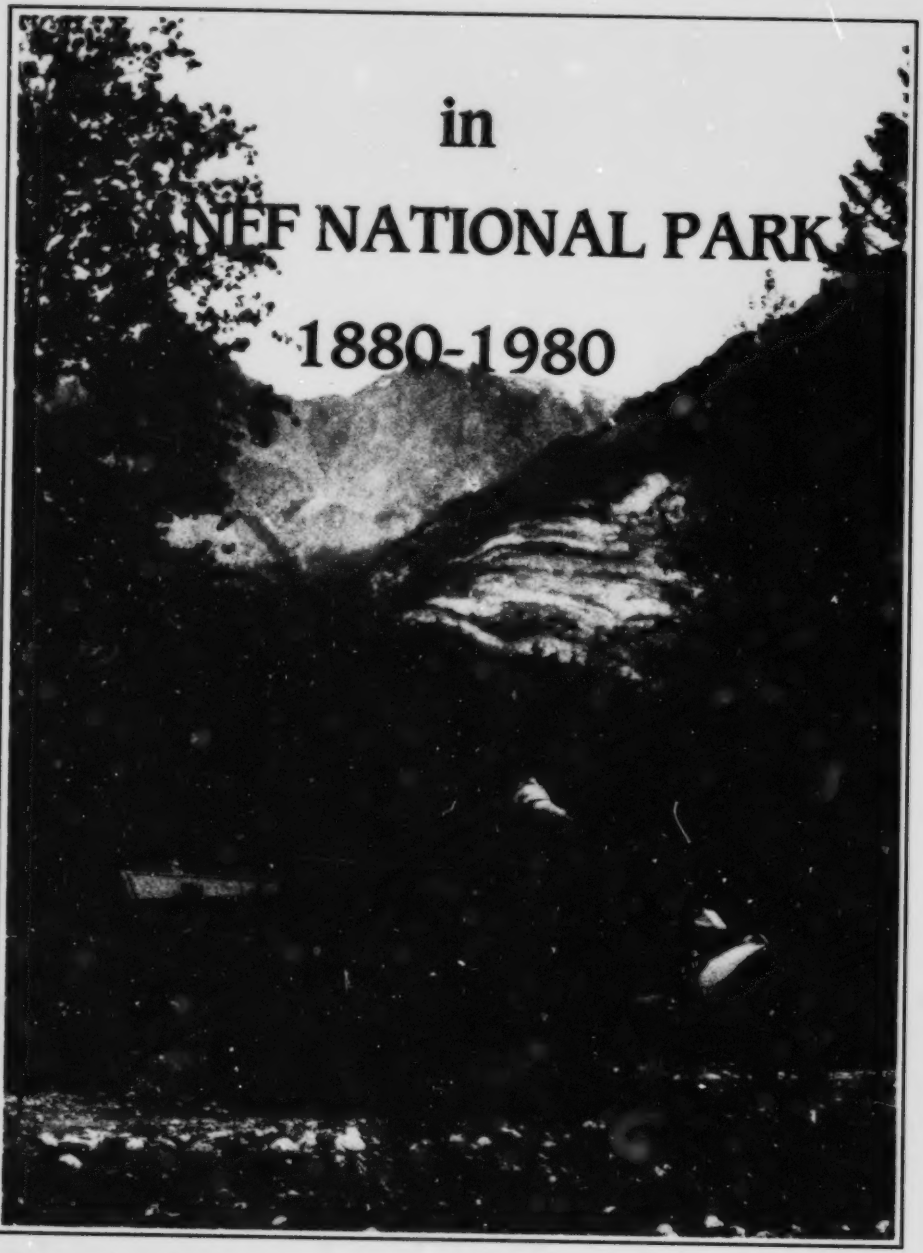
WILDLAND FIRES



in

NEF NATIONAL PARK

1880-1980

Parks Canada Parcs Canada

86-0995/

WILDLAND FIRES
in
BANFF NATIONAL PARK
1880-1980

Cliff White

Occasional Paper No. 3

National Parks Branch
Parks Canada
Environment Canada
1985

©Minister of Supply and Services Canada, 1985.

En français ce numéro s'intitule **Les incendies de forêt dans le parc national Banff 1880-1980** (nº de catalogue R61-2/8-3F).

Catalogue No.: R61-2/8-3E
ISBN: 0-662-14245-4

Published under the authority
of the Minister of the Environment,
Ottawa, 1985.

Layout and design: Paula Irving

Cover: Forest fire auto in Banff National Park, ca. 1915.

CONTENTS

4 Foreword
5 Preface and Acknowledgements
7 Introduction
9 Banff National Park — A Brief Description
9 Geology
9 Climate
11 Vegetation
15 Human History and Prehistory
18 Methods
22 Fires and Fire Control — A Chronological Description
22 Before 1880
25 1880-89
30 1890-99
36 1900-09
47 1910-19
54 1920-29
61 1930-39
67 1940-80
78 Other Fires
79 Summary Statistics and Analysis
79 Fire Location and Size
82 Area Burned and Number of Fires by Decade
84 Ignition Sources
87 Precipitation and Fire
89 Period of Burning
92 Direction of Burn
93 Results of Fire Control Efforts
94 Threats to Public Safety, Park Facilities, and Provincial Lands by Random Ignition Fire
97 Conclusions
99 Appendix A. Banff National Park Vegetation Types
102 Literature Cited

Submitted for publication in 1984 by Cliff White, Park Warden, Banff National Park. Mr. White holds a Bachelor of Forestry from the University of Montana and recently completed a Masters in Forestry from Colorado State University. Mr. White, who grew up in Banff townsite, joined the Banff Park Warden Service ten years ago. Among the other interests a park warden is expected to maintain, Mr. White is also responsible for vegetation resources in Banff National Park. Accordingly, he is developing a fire management plan for Banff Park in accordance with the Parks Canada fire policy.

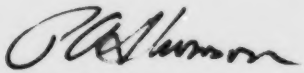
FOREWORD

The Occasional Paper Series is designed to deal with issues in national park management. This paper, the third in the series, differs from the previous two in that it is specific to one park, Banff National Park. Notwithstanding this narrow scope, it has wider repercussions. On the technical level, the results will be of interest beyond Banff National Park. Also, others may find the methods useful in the design of their particular studies. The anecdotal part of the paper, which documents changes in park management approaches over the past 100 years as well as the changing societal perceptions of fire, will attract additional readers. The end result of a wide readership is the promulgation of the Parks Canada fire policy. For fire management to succeed in national parks, Canadians must understand and support such initiatives.

The 1979 Parks Canada policy allows for natural processes, such as fire, to function in a park whenever specific conditions are met. One prerequisite, of course, is establishing that fire in a specific park is indeed a natural occurrence. Studying past fires not only determines this essential fact but also provides knowledge on the nature of fires and their effects. These elements are integral to the success of a fire management program.

Papers published in the Occasional Paper Series are available in both official languages. Suggestions for topics and comments on published papers will be reviewed by an editorial committee. The content of papers in this series reflects the views of the authors and is not necessarily the position of Parks Canada.

All comments or suggestions should be sent to the Director, National Parks Branch, Parks Canada, Ottawa, Ontario, K1A 1G2.



P.A. Thomson
Director
National Parks Branch

PREFACE AND ACKNOWLEDGEMENTS

Parks Canada is moving towards allowing fire to play as natural a role as possible in managing the ecological resources of national parks. To meet this objective, Banff National Park has undertaken a series of studies in fire history, fuel appraisal, historical weather conditions, vegetation ecology, and other fire-ecosystem related topics. This history of wildland fires since 1880 in Banff National Park is a partial product of this work.

As with any resource management planning effort, this report could not have been prepared without substantial help from numerous individuals. Superintendents Paul Lange and Jim Vollmershausen, Assistant Superintendent Tom Ross, Chief Park Wardens Anderson and Fortin, and Assistant Chief Wardens Whyte, Everts, McKnight, and Kutzer all provided the necessary park management support for the work. Parks Canada Western Regional Office staff Pat Benson, Kurt Seel, and George Rogers have helped carry the ball in Regional Office. Marty Alexander, Dennis Dubé, Peter Achuff, Bruce Walker, and Gilles Delisle at the Canadian Forestry Service Northern Forest Research Centre, and Phil Omi, Rick Laven, and Peter Roussopoulos of Colorado State University have provided timely advice in and out of the field. Brian Patton, Jon Whyte, and Ed Cavell of the Archives of the Canadian Rockies have also provided special help in digging into the written and photographic history of the park.

I wish to thank Moe Vroom and Bev Trim for typing initial drafts and Ian Joyce for preparing the figures. Nikita Lopoukhine of Parks Canada's headquarters in Ottawa was also instrumental in getting this report published. Three anonymous reviewers helped reshape this paper into a more complete background of fire management in Banff National Park.

Those who thrashed through the bush, sifted through the archive files, and sanded hundreds of wedges include park volunteers Ken Baker, Chris Campbell, Mike Eder, Mike Fearnell, and Wendy Yurka, and term Wardens Ed Abbott, Rob Ashburner, Dave Fanjoy, John Kellas, and Wes Olson. Sadly Dave Fanjoy, who provided hours of good company in places and at times when it was really needed, died recently while climbing Mt. Temple's east ridge. This report is dedicated to him — he would have made a good Warden.

"What next ?" queries a visitor to Banff, who has spent the summer here. A late spring, cold weather in May and June, swarms of mosquitoes in July and August, and now the air is heavy with smoke from forest fires. An old timer asserts that the next thing on the program is a snow storm — followed by a real genuine Indian summer during September and most of October.

From the Banff *Crag and Canyon*
during the August 1920 fires.

INTRODUCTION

Parks Canada is developing management plans to use wildland fire to maintain fire-dependent vegetation within national parks. Interpreting Parks Canada policy, national parks will, within the constraints imposed by public safety and facilities protection, allow some randomly ignited (accidental human- and lightning-started) fires to burn, and where required, use planned ignition (prescribed) fires (Lopoukhine and White 1983).

Banff National Park (BNP) began a fire management planning project in 1980 to determine the ecological function of fire in BNP ecosystems and to implement a plan to restore fire to its natural role. Project components include an analysis of fire history, evaluation of fire weather and behavior during recent fires, and description of BNP vegetation development with or without fire. The planning project requires staff training and organization, small planned ignition fires for research purposes, and public information and involvement programs.

Wildland fire is recognized as an important component in the ecology and evolution of many plant communities. Several studies document fire history before the establishment of national parks in the Canadian Rocky Mountains (Tande 1979; Hawkes 1979; White 1984). This research shows that before the 1880s fires were relatively frequent in low elevation forest stands with mean fire return intervals (average time between fires in a defined area) often ranging from 20 to 40 years. In higher elevations, forest fires burned less frequently due to cooler, moister conditions.

Fire occurrence in BNP since 1880 has not been thoroughly evaluated. Byrne (1964) provides preliminary evidence that fires may have been abnormally widespread from 1880 to at least 1900 due to construction of the railroad and early land use practices in the park. Subsequent to approximately 1910, a sharp decrease in burning occurred, usually attributed to the establishment of the National Park Warden Service and the implementation of fire control programs (Van Kirk 1969). Another suggested explanation for fewer fires is a corresponding lower frequency of drought periods that would normally favour extreme fire behavior. However, these interpretations of fire activity in BNP since 1880 are based only on general information. As a result, trends in the area burned over time have not been confirmed. The cause of fires and the effects of fire suppression have not been analysed. Thus, the impacts of European settlement and subsequent fire control policies in BNP are not well understood.

Detailed fire history information for 1880 to 1980 can influence current fire planning in BNP. For example, a possible management option in several undeveloped areas is to allow some random ignition fires to burn with only limited suppression action. Important questions that must be answered before this approach is taken include: How much fire could be expected in the absence of suppression actions? Which directions will fires burn? What park areas will be most fire prone? During what periods of the year do different portions of the park tend to burn? Complete fire history information can help answer these questions.

The purpose of this study was to reconstruct a history of wildland fires in BNP since 1880. Primary objectives were the following:

1) date and locate all fires (over 40 ha in area) for 1880 to 1980;

2) analyse trends in burned area as a function of time, particularly in reference to possible widespread burning early in the period, and a decrease in fire activity thereafter;

3) assess possible causes of trends in burned area, especially those related to ignition source, climatic change, or fire supression efforts;

4) document information on the timing, direction of burn, and behavior of historic fires.

This study gathered historical documentation of fires from archived reports and newspapers, and dated fire scars and forest stand regeneration throughout the park. The analysis of fire occurrence since 1880 provides information not only on historic fires, but also on the organization of the Warden Service and the development of a preservation-oriented park administration. Because BNP is Canada's oldest national park, these developments have often had country-wide implications. A major section of the report is devoted to a chronological history from 1880 to 1980 of anecdotal accounts of fires and fire control activities such as prevention, detection and suppression. I hope the complete descriptions of fire locations, dates, and behavior will be useful for possible future studies of BNP fire behavior and ecology. The chapter Summary Statistics and Analysis provides an overview of random ignition fire in BNP, which is essential background information for fire planning effort.

BANFF NATIONAL PARK — A BRIEF DESCRIPTION

Essential to interpreting the history of Banff's wildland fires is an overview of the park's environment and history.

Geology

The geological structure of BNP provides a primary control on climate and vegetation, and thus fire activity. The park (Fig. 1) is composed of northwest to southeast trending ranges of the Rocky Mountains. The main ranges along the Continental Divide form the park's western half, and the front ranges predominate in the eastern portion.

The main ranges appear as massive mountain structures (many peaks exceed 3000 m elevation) spaced by steep walled valleys cut in horizontally banded strata (North and Henderson 1954). Icefields and glaciers are common. In contrast, the front ranges have less vertical relief, the wide valleys hemmed by thrust fault block ridges rarely exceeding 3000 m.

The general northwest to southeast lay of the valleys is periodically broken by eastward trending drainages such as the North Saskatchewan, Red Deer, and Bow (Fig. 1). The valleys of these rivers are broad and U-shaped from past glacial activity, having areas below 1500 m elevation. The low elevations of these valleys (holding broad vegetated regions) and their orientation with respect to the prevailing winds have made them primary locations for fire activity. At higher elevations the barren mountain ridges provide fuelbreaks between most of Banff's valleys, unlike the lower rolling foothills to the east of the park boundary.

Climate

Janz and Storr (1977) provide a climatic analysis for the BNP area. In general the climate is continental with relatively long, cold winters and short, cool summers with occasional hot spells. Wide variations from average conditions occur.

Figures 2 and 3 profile mean monthly temperatures and precipitation for Banff and Lake Louise observation stations. The warmest months are July and August with mean monthly temperatures near 15°C. Janz and Storr (1977) note that maximum summer temperatures occur most frequently from mid-July to early August. Temperatures greater than 30°C are uncommon and there is usually a pronounced cooling as elevation increases. Cold air drainage and inversions are frequent in January, but can occur throughout the year.

Precipitation varies widely in the park, averaging from less than 500 mm in the lower valleys of the Bow and North Saskatchewan to greater than 1250 mm in the main ranges of the northern part of the park (Fig. 4). In the Banff townsite area a continental precipitation regime prevails with winter minima and spring/early summer maxima (Fig. 2). Moving west to Lake Louise more maritime conditions occur, and maximum precipitation occurs in winter. July is the dryest month (Fig. 3).

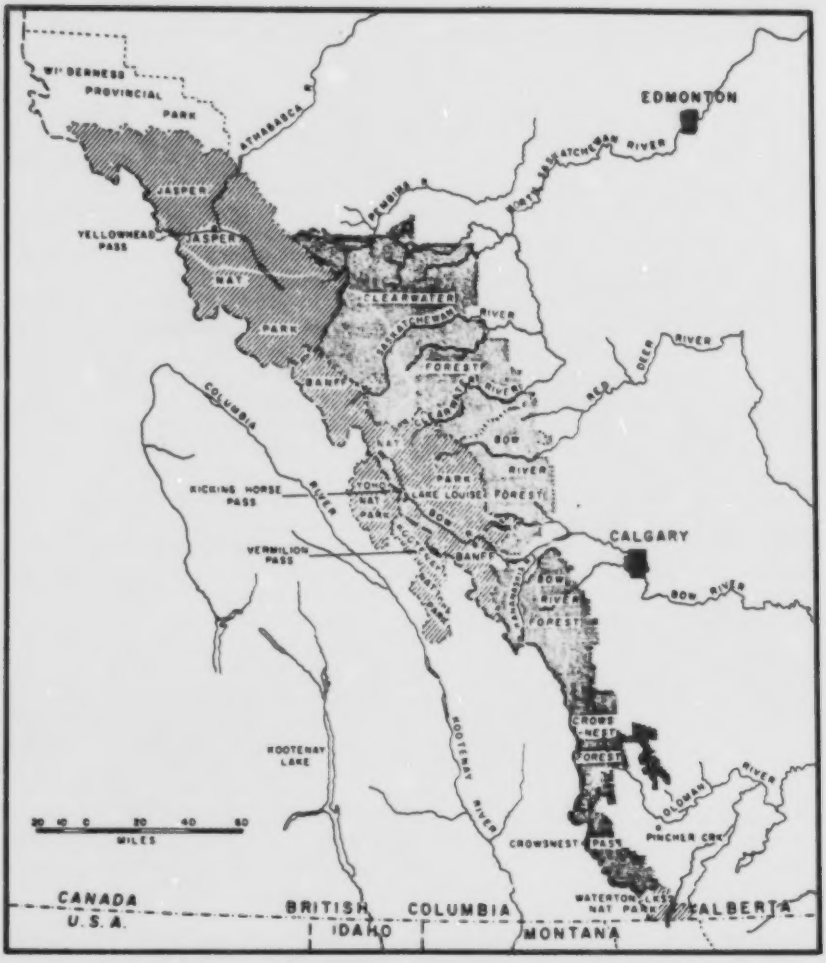


Fig. 1. Banff National Park and surrounding lands.

Winds blow mainly from the west, but are strongly shifted by mountain ranges (Janz and Storr 1977). Highest winds are found at upper elevations, and also on the park's east boundary along the low elevation east-running valleys such as the Bow and North Saskatchewan. The windy conditions and low precipitation in these areas have created a semi-arid environment that is conducive to fire (Tande 1977).

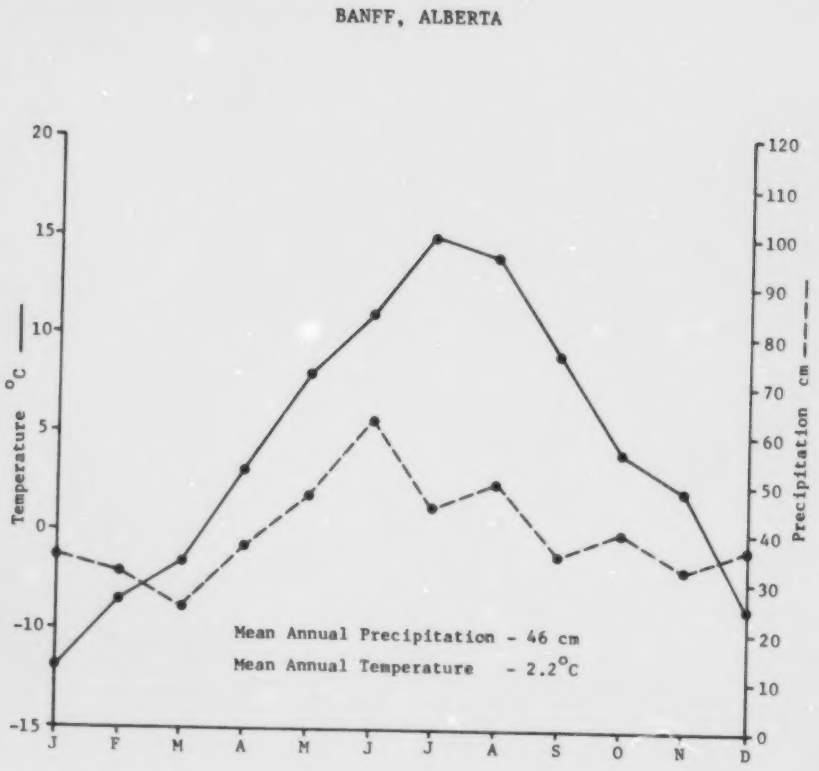

BANFF, ALBERTA
Temperature °C
Precipitation cm
Mean Annual Precipitation - 46 cm
Mean Annual Temperature - 2.2°C
J F M A M J J A S O N D

Fig. 2. Monthly temperature and precipitation means at Banff, Alberta.

Vegetation

Detailed descriptions of Banff's vegetation types and distribution are provided by the biophysical inventory (Holland and Coen 1982). The inventory divides the park into four ecoregions. In increasing elevation these are the montane, lower subalpine, upper subalpine, and alpine. Table 1 provides a grouping of vegetation types based on this scheme (White 1984). Descriptions of vegetation types are found in Appendix A.

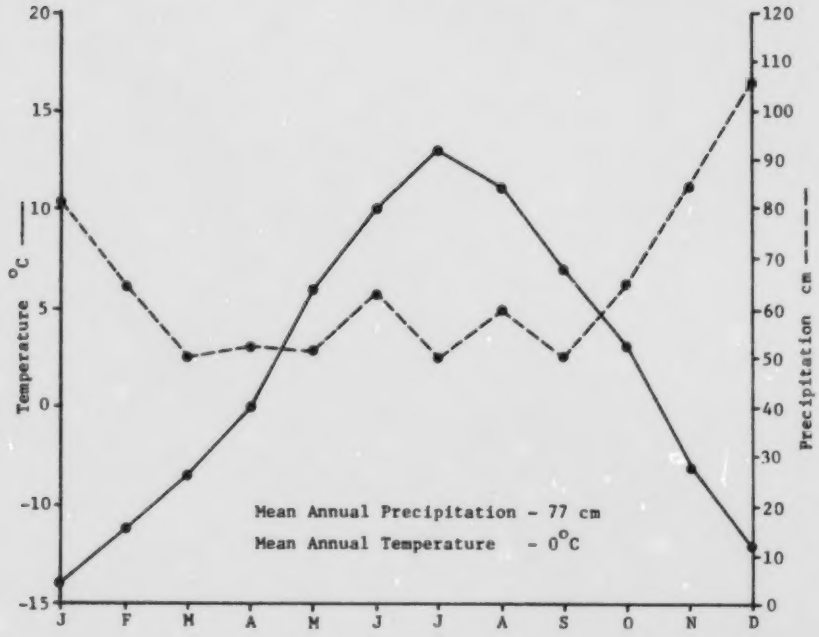


Fig. 3. Monthly temperature and precipitation means at Lake Louise, Alberta.

The montane zone is the most limited ecoregion within BNP (less than 2% of the total area) and lies at low elevations and on south-facing slopes from 1300 to 1600 m elevation. On well-drained montane sites, grasslands and forests of Douglas-fir, trembling aspen, and lodgepole pine show evidence of the most frequent fires in any areas of both Banff and Jasper National Parks (Tande 1977; White 1984). Moist sites in the montane are occupied with white spruce, balsam poplar, and wetland communities with longer fire return intervals.

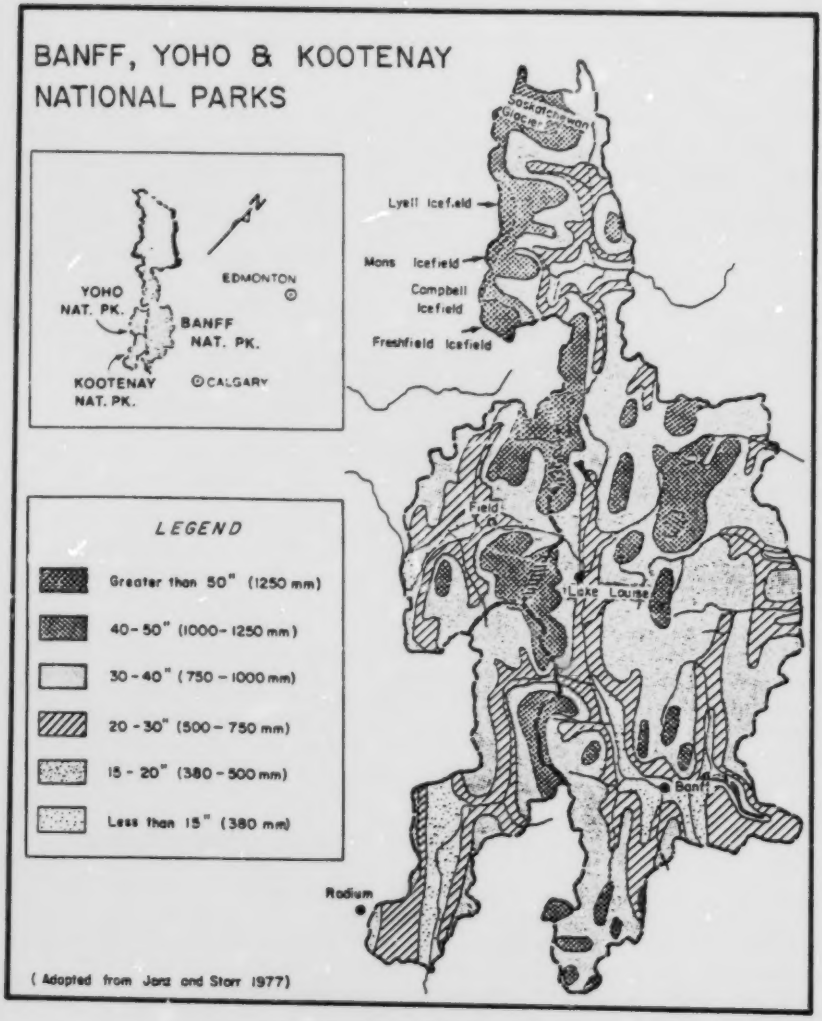


Fig. 4. Average annual precipitation for Banff National Park area.

The lower subalpine ecoregion constitutes approximately 25% of BNP and is covered mainly by dense forests of lodgepole pine, Engelmann spruce, and subalpine fir. Fires in these areas are often intense, totally removing the forest cover and regenerating stands of even-aged lodgepole pine (Horton 1956). Should these stands remain fire-free for more than

Table 1. Banff National Park vegetation types

Ecoregion	Area (ha)	Vegetation	BNP area (ha)	Dominant vegetation types[a]
Montane	15 727	Dry montane closed forest	8 795	C1,C3,C6,C19
		Montane aspen closed forest	1 332	C16
		Mesic montane closed forest	2 302	C5,C26,C37,C2,C27
		Montane open forest shrublands and grasslands	3 298	Numerous
Montane lower subalpine	6 877	Montane lower subalpine Riparian closed forests	6 877	C4,C32
Lower subalpine	180 276	Warm lower subalpine closed forests	128 928	C3,C6,C9,C11,C13, C18,C19,C31,C37
		Cool lower subalpine closed forests	38 716	C14,C20,C29,C30
		Lower subalpine open forests and shrublands	12 632	Numerous
Upper subalpine	201 437	Upper subalpine closed forests	99 987	C13,C23,C33, C34,C24
		Upper subalpine open forests and shrublands	101 450	Numerous
Alpine	40 825	Alpine meadow and shrublands	40 825	Numerous
Unvege-tated	247 599	Rock, colluvial rubble talus and glaciers	247 599	

[a] Described in Holland and Coen (1982) and Appendix A.

approximately 200 years, the lodgepole begins to succumb to disease and insect attack. Engelmann spruce and subalpine fir then begin to dominate (Day 1972).

BNP's upper subalpine region has mainly open forests of Engelmann spruce and subalpine fir, interspersed by dwarf shrub, meadow, and

avalanche communities. The upper subalpine comprises nearly one-quarter of Banff's area and is characterized by cool, moist conditions and longer fire return intervals than lower elevation ecoregions (Tande 1977; Hawkes 1979). Above the upper subalpine is a treeless alpine ecoregion of meadow and dwarf shrub (about 5% of Banff's area). The large remaining portion of the park (over 35%) is unvegetated rock, talus, moraine, and glacier.

Human History and Prehistory

Information on human use of the park area is provided by archaeological studies (Reeves 1974; Christenson 1971; Damp et al. 1980) and historical literature reviews such as Van Kirk (1964) and A.R. Byrne's (1964) *Man and Landscape Change in Banff National Park Before 1911.* Byrne's breakdown of historical periods is used in this description.

Pre-European Period

Archaeological evidence indicates occupation of the area by Paleo-Indians by 10 000 - 9000 B.C. Although there were some interruptions due to climatic cooling and glacial advances, population densities increased over time. Christenson (1971) reported that 200 A.D. to 1500 A.D. was a period of "intensive human occupation of Banff." This aboriginal culture was well adapted to the mountain conditions, probably using permanent winter settlements in the lower montane valleys and exploiting subalpine and alpine areas during the summer (Damp et al. 1980). The expansion of European occupation across the continent caused the collapse of this long-evolved resident culture by about 1750 A.D. which marked the arrival of the Mountain Stoneys (Assiniboines) and Crees.

Fur Trading Period (ca. 1775-1850)

The Banff Park area appears to have been little used by man during this period (Byrne 1964). The hostile Piegan tribe blocked fur traders from using most passes across the Rockies in the park. The Northwest and Hudson's Bay companies established trading posts on the North Saskatchewan and Bow rivers just outside the mountains. However, the foothills area probably was more important for fur trapping than the narrow valleys of the mountains (Byrne 1964).

Prospecting and Early Railroad Period (1850-1887)

Despite the large amount of prospecting and gold rushes in other areas of Western Canada after 1850, the Banff region was probably infrequently visited by prospectors before the coming of the railroad due to mineral-poor sedimentary rock and little-known travel routes (Byrne 1964). In 1881 and 1882 the Canadian Pacific Railroad surveyed potential routes

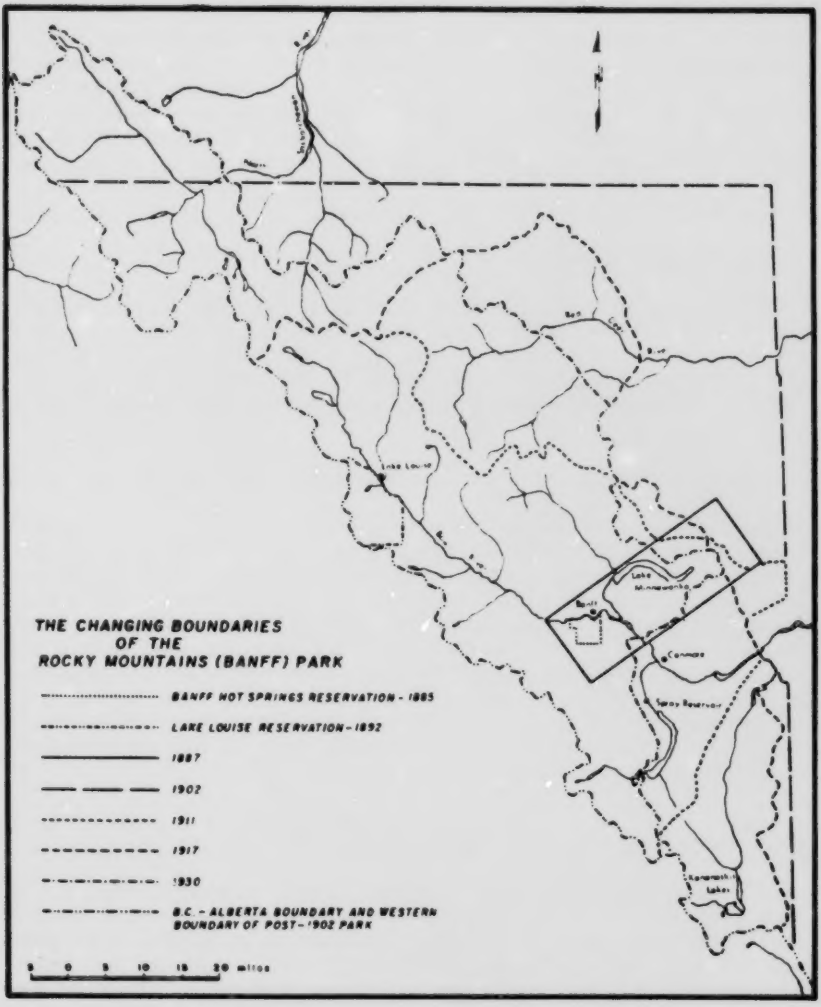


Fig. 5. The changing boundaries of the Rocky Mountains (Banff) National Park.

through the Howse, Kicking Horse, and Kananaskis passes, and constructed the railroad over Kicking Horse Pass in 1883 and 1884 (Bone 1947; Wilson 1972). Concurrent with the railroad construction (and for several decades after), large areas of the Bow watershed were logged, and much mineral exploration occurred. The boom town of Silver City (near Castle

Junction) grew to some 1500 inhabitants in the early 1880s only to dwindle to dust by 1885.

The Park Period (After 1887)

An Order-in-Council in 1885 and the Rocky Mountain Parks Act of 1887 provided the foundations for today's BNP. Early administrators of the park stressed economic development through tourism and industries such as logging and mining (Byrne 1964). Through the years Parliament made numerous boundary changes to provide for more logical boundaries and for increasing concerns in preservation (Fig. 5). In 1930 the National Parks Act was passed; this emphasized nature preservation and excluded industrial towns such as Canmore and Exshaw from the park along with the area of the proposed Spray Lakes hydroelectric development (Van Kirk 1969).

Visitors to Banff have increased astronomically from less than 10 000 in 1900, to approximately 160 000 in 1930, and to over 5 000 000 in 1980 (Dept. of Interior Annual Reports; Superintendent's Reports). Much of today's park management is concerned with providing facilities to the large number of visitors while attempting to preserve important aspects of the natural environment.

METHODS

Methods of study were designed to gather fire history information for the period 1880 to 1980 and to evaluate possible fluctuations in burned area due to the occurrence of man-caused fires, fire suppression actions, and possible climatic changes.

Fire Location and Size

Four sources of information provided data on the location and dates of fires in BNP since 1880:

1) Historical Records and Reports — although the majority of Banff National Park records (Warden diaries, fire reports, etc.) preceding 1967 could not be located, many references such as Superintendent reports and letters, Department of Interior reports and newspapers provide accounts of historical fires. The Archives of the Canadian Rockies (Banff) and the Glenbow Foundation (Calgary) were the primary sources of this information.

2) Fire Scar and Stand Origin Analysis — Wardens determined fire scar and stand origin dates for 275 sample plots of approximately 20 ha each in Banff National Park during 1980 and 1981 (Fig. 6). Using the methods of Arno and Sneck (1977), Tande (1977), and Hawkes (1979) burn years were estimated by counting annual rings on cross sections from live trees, snags, and logs. A master chronology was used to compare sample stands adjacent to each other and to synchronize burn years if required. Dates determined with these methods are within a range of $\pm$ 1 year for the 1900s and $\pm$ 2 years for the latter 1800s. Of the 275 plots, 220 plots were used in a concurrent study of fire and biomass inter-relationships and pre-1880 fire history in BNP (White 1984).

3) Historical Photograph Analysis — the work of early photographers in the Banff area such as Byron Harmon, plus the 1930 to 1954 air photographs of the Department of Energy, Mines and Resources provide excellent sources of information to interpret fire history. Much evidence of early fires since obscured by vegetation succession is visible on these photographs and so were used to delineate fire margins.

4) Cascade Fire History Study — Marsh (1979) conducted a detailed study of fire history in the upper Cascade Valley as part of a grizzly bear ecology project (Hamer and Herrero 1983). We used this study where applicable.

All the above information was categorized by location, date, and ecoregion as classified by the ecological land classification (Holland and Coen 1982). The 220 detailed fire history plots were also categorized by vegetation type using the key provided by Holland and Coen (1982). Preliminary fire boundaries were plotted on air photographs then transferred to 1: 183 000 scale park maps. These maps were used to approximate areas burned by each fire.

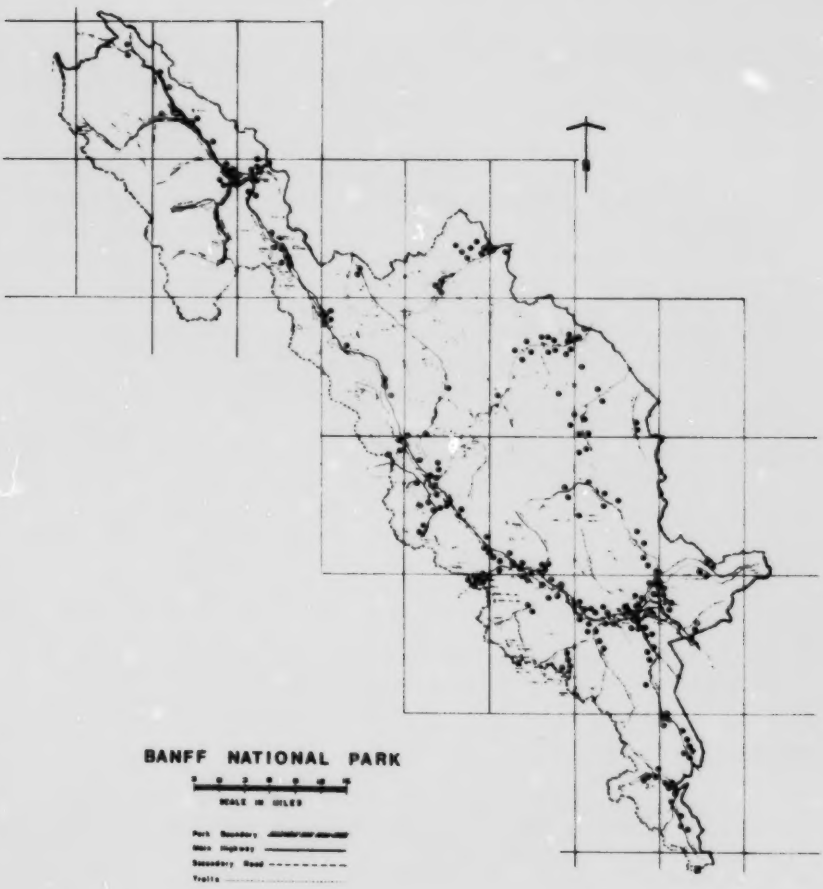


Fig. 6. Fire history sample stands.

Fluctuations of Area Burned, Number of Fires, and Time Relation

Time-related trends in fire activity were analysed in two ways. Firstly, the number of fires and burned area were broken down by decade. Secondly, the known fire years for 188 detailed fire scar and stand origin plots were used to calculate the time-since-fire on each plot as of 1880, 1930, and 1980. Time-since-fire distributions provide a useful method of determining fire frequency for the period prior to the year for which they are calculated (Van Wagner 1978). In this case, sample plots were clustered on the basis of vegetation type, site, fire history, biomass, and

fire behavior characteristics (as described in White 1984) into four groups: warm-dry montane, warm-dry lower subalpine, cool-moist lower subalpine, and upper subalpine. Distributions and means for time-since-fire as of 1880, 1930, and 1980 were calculated for each group to evaluate changes of fire frequency with time. For example, a decrease in the mean time-since-fire as of 1930 compared with 1880 would indicate a higher fire frequency during the period 1880 to 1930 compared with pre-1880 conditions.

Ignition Sources

For analysis purposes, the specific ignition source for all fires was categorized under one of the following headings:

1) Recreation – accidental fires started by recreational users of BNP such as campers or fishermen;

2) Settlement – accidental fires resulting from the operation or development of the communities of Lake Louise and Banff;

3) Railway – accidental fires resulting from the construction of the railroad, operation of locomotives, or track maintenance activities;

4) Other industry – accidental fires resulting from timber operations, mining, highway slashing, or other construction operations;

5) Incendiaries – purposely started fires by unlawful individuals;

6) Miscellaneous man-started – other man-caused fires of assorted origin;

7) Lightning – fires apparently started by lightning;

8) Unknown – fires started by unknown causes.

Precipitation Trends

An important aspect of this study was to evaluate whether trends in the area burned were a function of possible climatic changes. Precipitation from Banff townsite for the period 1890 to 1980 was used as a long-term climatic indicator. The quantity of precipitation is a significant weather factor that influences fuel moisture and hence potential ease of fire ignition and fire spread (Shroeder and Buck 1970). Long periods of drought typically precede most large historic fires in the northern Rocky Mountains (Tande 1979).

In this study, we summed daily precipitation for each of the following quarterly periods: spring (April, May, June), summer (July, August, September), fall (October, November, December) and winter (January, February, March). Based on an ordination of spring and summer precipitation, a threshold precipitation line was defined. Prior to 1941, all years with spring and summer precipitation below the threshold had large fires. The frequency of below threshold years as a function of time was then used as an indicator of potential change in the fire climate.

Admittedly, quarterly precipitation is only a crude indicator of potential fire activity and climatic change. However, it provides a relatively long-term basis for analysis. A more ideal approach would require calculation of the Canadian Forest Fire Weather Index (Van Wagner 1974)

and a frequency analysis of index values. Unfortunately, weather observations required for the index's calculation are inadequate prior to approximately 1950.

Additional Analyses

The information gathered on fires after 1880 allowed the analysis of several other topics. The period of burning (day and month) was summarized for all fires with known dates. Grouping fires into montane, lower subalpine and upper subalpine ecoregion permitted an assessment of the period of burning for individual ecoregions. The direction of burn for many fires was determined from both historical documentation and burn patterns visible in photographs. Although the official reporting on the effects of fire control activities often appears over-optimistic, the historical documentation allowed some evaluation of fire prevention, detection, and suppression efforts. Finally, knowing the location, size, and direction of burn of historic fires provided a basis for assessing future management use of random ignition fires in different BNP areas.

FIRES AND FIRE CONTROL — A CHRONOLOGICAL DESCRIPTION

Before 1880

Although this paper focuses on the period 1880-1980, a brief description of fire history information available for the Canadian Rockies prior to 1880 is useful.

Tande (1977, 1979) intensively studied fire scars and stand origins in sample plots of approximately 40 ha around Jasper townsite in Jasper National Park. He discovered that fires were more frequent in the period before European occupation with a mean fire return interval of approximately 20 years in dry montane Douglas-fir and lodgepole pine stands, and about 70 years in lower subalpine lodgepole pine stands.

> The area burned per year in the study area fluctuated erratically and was not well correlated with human use patterns, especially the larger area burned per year before the arrival of the white man. Therefore, climate is believed to be the principle factor that controlled the frequency and extent of past fires (Tande 1977).

In Kananaskis Provincial Park, a 508-km^2 area in the subalpine and alpine ecozones south of BNP, Hawkes (1979) reports similar extensive fires prior to 1880. Mean fire return intervals ranged from approximately 100 years in lower subalpine lodgepole pine sample stands (approx. 40 ha) to over 300 years in upper subalpine stands. Hawkes concluded that "the 'natural' fire regime of Kananaskis Provincial Park was that of large (over 1000 ha) fires with medium to high fire intensity at infrequent intervals" and that in the provincial park as a whole "the longest interval between major fires between 1712 and 1920 was 38 years."

In BNP the Warden Service has dated numerous fires before 1880 (White 1984) using fire scars and stand origin data. Mean fire return intervals increased with elevation and precipitation from approximately 30 years in 20-ha montane aspen and Douglas-fir sample plots to greater than 200 years in upper subalpine Engelmann spruce and subalpine fir. Table 2 summarizes this information, comparing it with that from Tande (1977, 1979) and Hawkes (1979). This comparison shows that fires were probably frequent throughout the Canadian Rockies prior to intensive European use.

Fire intensities also varied similarly in the Jasper, Banff, and Kananaskis areas. On the dry montane sites the relatively frequent return of fire appears to have allowed only low fuel accumulation; thus fires were often of low intensities, not killing all the overstory trees (Tande 1977; White 1984). The incomplete tree mortality created open stands of several different age classes. In the lower and upper subalpine areas longer fire return intervals allowed greater fuel accumulations. When fires did burn in these stands (under periodic drought conditions) fire intensities were high, often killing all trees and resulting in even-aged regeneration (Tande 1977; Hawkes 1979; White 1984).

Although most researchers agree that climate controlled the ultimate extent of burned areas, and that lightning was a common ignition source,

Table 2. Mean fire return intervals for small forest stands (20-40 ha) in the Canadian Rocky Mountains

Ecoregion	Vegetation types	Mean fire return intervals (years)		
		Banff (White 1984)	Jasper (Tande 1977)	Kananaskis (Hawkes 1979)
Montane	Dry montane forests of Douglas-fir, lodgepole pine, whitebark pine (C1,C3,C6)	42	18-27	-
	Montane aspen forests dominated by trembling aspen (C16)	21	-	-
	Mesic montane forests of white spruce, Douglas-fir, and pine (C2,C5,C26,C27,C37)	56	-	-
Montane/ Lower subalpine	Riparian forests of white and Engelmann spruce (C4,C32)	77	-	-
Lower subalpine	Warm/dry lower subalpine forests of lodgepole pine, Engelmann spruce, subalpine fir (C3, C6,C9,C11,C13,C18, C19,C31,C37)	94	33-42	101[a]
	Cool/moist lower subalpine forests of lodgepole pine, Engelmann spruce, subalpine fir (C14, C20,C29,C30)	130	90-131	101[a]
Upper subalpine	Upper subalpine forests of subalpine fir and Engelmann spruce (C15,C23,C33,C34)	181	-	304

[a]Fire return interval data pooled for warm/dry and cool/moist lower subalpine ecoregions.

the role of aboriginal man in starting fires is questioned. Byrne (1964) and Day (1972) believed that ignitions increased in the latter 1800s with the influx of Europeans into the Canadian Rockies. Conversely Barrett (1981) studied the widespread use of fire by the Kootenays of Northern Montana and Idaho. This group of Indians also utilized the Banff area prior to 1800

(Byrne 1964). Barrett concludes that "Kootenai Indians were largely responsible for causing high (fire) frequencies characteristic of stands in habitation zones." Similarly Lewis (1980) studied the role of fire in the Beaver and Cree Indian cultures of Northern Alberta. These groups occupied the Jasper area prior to 1880 (Anderson and Reeves 1975). Lewis found frequent and sophisticated use of fire by these peoples for such purposes as maintaining wildlife habitat and clearing travel routes.

The Rocky Mountain Stoneys hunted in the BNP area in the 19th century. Byrne (1964) concluded that the Stoneys did not often deliberately burn Banff's forests. However, J.E. Stauffer, a Forest Ranger in southern Alberta, reported:

> I always understood that Indians would never set out fires in the forests, but this year I was convinced that they do; for hunting purposes, in season or out, in the Banff Park and out of it. They set out fires in the spring on their fishing and hunting trips in order to draw deer later for grazing (Dept. of Interior Annual Report for 1906).

Early European explorers also occasionally started fires before 1880 in the Banff Park area. While exploring the North Saskatchewan Valley, Dr. James Hector's party failed to extinguish a campfire on 11 September 1858, and burned "a large area of forest" near Glacier Lake. Further north, Milton and Cheadle nearly started a fire while following the Athabasca River in June of 1863.

> In meantime we had dinner & very nearly set the forest on fire, the horses trampling some of the embers of their fire into a fallen pine tree which quickly set fire to some neighbouring standing trees, & I thought we could not save it. I seized an axe & cut down the nearest trees. But then the little black horse getting burnt a little, got frightened & rolled in the fire & I had to seize a great pole & beat him about the head before he would get out again. I thought he was done for, but he turned out little injured. Whilst this was going on, the fire had again got head & I set to work with the axe & shouted to the rest to bring water, & Milton's activity & presence of mind in helping me to some at once saved us & we got the fire under by sundry pansful. Whilst I was energetically cutting trees & crying for water, I observed O'Byrne sitting down, tugging away at a boot. I shouted to him very angrily, "Mr. O'Byrne, what on earth are you doing! why the devil don't you bring some water?" "I can't, I've got only one boot on", he said. "Are you a fool staying to put on a boot, when the forest will be on fire in a minute & you burnt to a cinder?", this frightened him & he jumped up & limped up with a pan of water very assiduously (Cheadle 1865).

Whatever the source of ignition, fires frequently burned before 1880 in BNP. Figure 7 is derived from stand history analysis work in the park and illustrates the time-since-fire distributions as of spring 1880 for montane, warm and cool lower subalpine, and upper subalpine sample plots. These distributions show that frequent fires prior to 1880 had maintained large

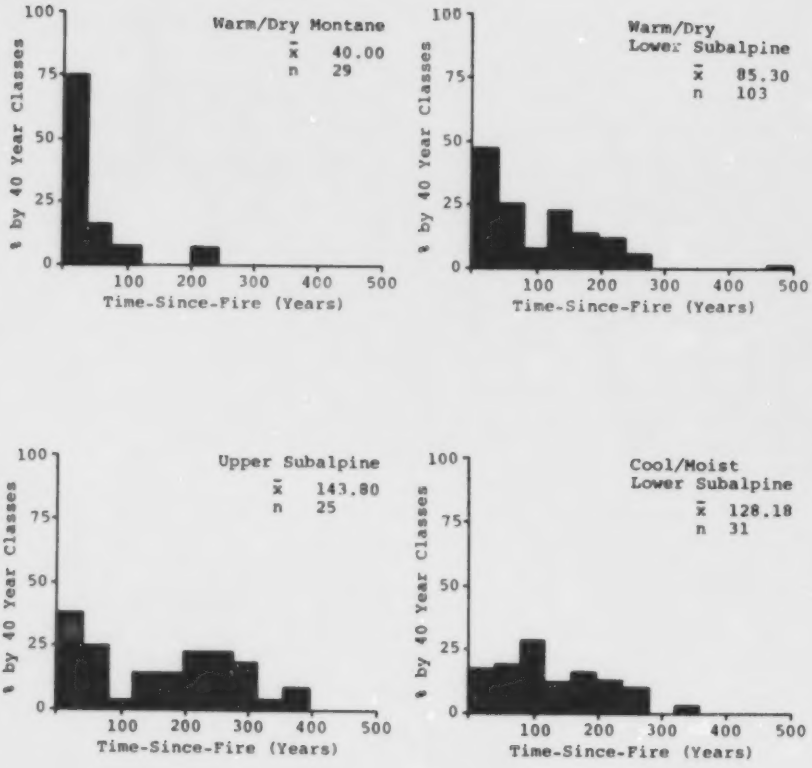


Fig. 7. Time-since-fire as of 1880 for Banff National Park fire history sample plots.

percentages of dry montane and lower subalpine stands in short time-since-fire classes. Less frequent fires in cool lower subalpine and upper subalpine stands resulted in less percentages in the younger classes in 1880. White (1984) provides additional interpretations of these time-since-fire distributions.

Thus in 1880, as the BNP area awaited the impending onslaught of surveyors, prospectors, loggers, railroad men, and tourists, its vegetation was already the product of vigorous fire activity.

1880-89

Large areas of the Bow and Cascade valleys burned between 1880 and 1889. However, poor historical records and reburning by later fires make

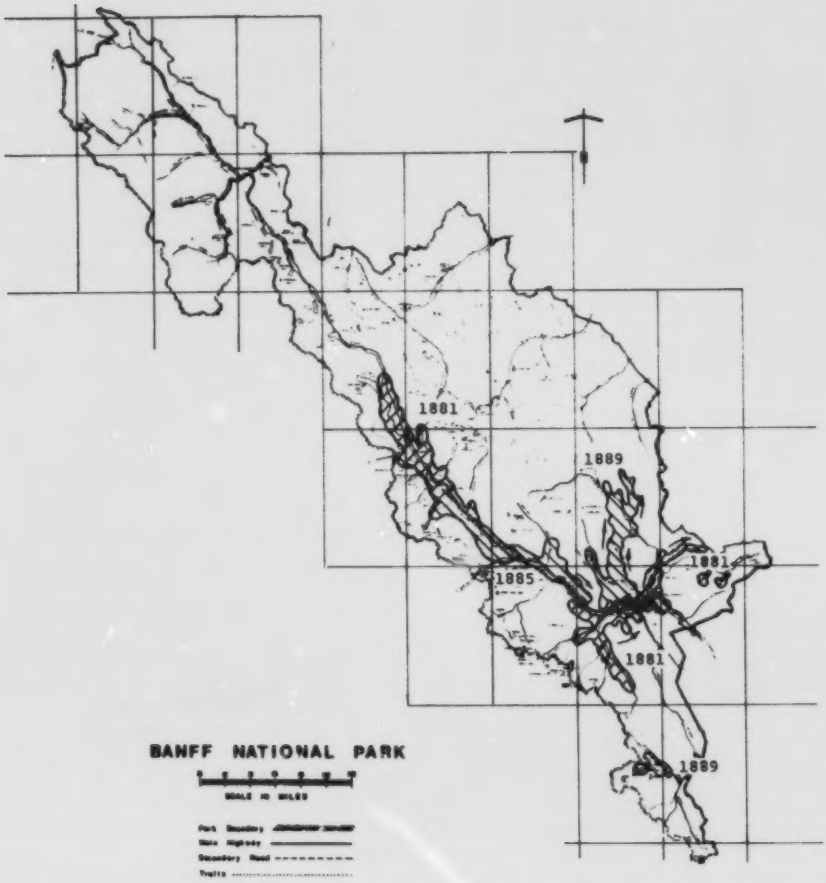


Fig. 8. Location of Banff National Park fires (1880-89).

it difficult to locate and date these fires accurately. Figure 8 shows approximate fire boundaries and Table 3 provides estimated areas and burn years from 1880 to 1889. The fires indicated are probably composed of several smaller fires whose boundaries are now indistinct.

1880-85: Railroad Construction Fire

Although several parties of prospectors and explorers (such as the 1857-60 Palliser Expedition) passed through the Banff Park area before

Table 3. Banff National Park fires (1880-89)

Year	Date	Location	Area burned (ha)	Cause	Reference
1881		Lower Bow Valley	8 000	Unknown.	Wilson (1972)
1881		Upper Bow Valley	7 000	Unknown	Wilson (1972)
1885		Mid Bow Valley	8 400	Unknown	Stand analysis
1889	May	Vermilion Lakes	100	Railroad?	Dept. Int. Reports
1889	20-30 June	Lower Bow - Cascade River	12 150	Unknown	Dept. Int. Reports
1889		Bryant Creek	1 400	Unknown	Stand analysis

1880, the exploration for the railway and its subsequent construction in 1883-84 brought the first large-scale use of the area by Europeans (Byrne 1964). From 1880 to 1885, over 20 000 ha (Table 3) burned in the vicinity of the Bow valley railroad right-of-way; many of these blazes were probably started by railroad surveyors and construction workers. A construction engineer provided a description for the Kicking Horse Valley to the west: "Forest fires started shortly after our camp had been set up. The mountain sides were ablaze..." (Bone 1947). Most of the burning of the Bow Valley probably took place in 1881. Tom Wilson was packing supplies up the Bow that year and recorded that "near Hole-in-the-Wall Mountain (Mt. Cory) we ran into a big forest fire and had to swim the swollen Bow twice" (Wilson 1972). In 1882 Wilson and Major Rogers began a trip up the Bow River from Kicking Horse Pass to Bow Summit:

> We crossed Bath Creek just above its mouth and cut across the 'nose' that lies between it and the Bow... After Sproat's gang (surveyors) had pulled out the previous year (1881), a bad forest fire had devastated a section of the country leaving thousands of half-burned trees covering the ground (Wilson 1972).

In June 1884 Dr. A.P. Coleman, Professor of Geology at University of Toronto, rode the railroad to "The End," which in that month was Laggan (now Lake Louise Village). He had some free time and set off on "an afternoon frolic" to climb what is today Mt. Whitehorn.

> The mountain nearest was to the east, and first we had to cross a swath of burnt woods — an abomination of desolation made up of black soil, black standing trunks, and black fallen logs — under a glowing sun that tried our temper.... It was only a commonplace mountain, about eight thousand feet high, without a name, so far as I am aware; but it belonged to the family of Rocky Mountains, and gave one an introduction to its stately neighbors, for here one could gaze up and down the pass with nothing but clean air between one and the summits, while down in the valley a trail of smoke from the 'right-of-way' where the timber was burning blurred and sullied the view (Coleman 1911).

1886-89: The Early Park Period

As the railroad brought more and more travellers to the Canadian Rockies, a sense of the area's value for tourism began to develop. On 25 November 1885, the Government of Canada reserved an area of 25 km^2 around the Banff hot springs (Fig. 5) to prevent "sale or settlement or squatting." That forest fires might marr the scenic greenery of the mountains was soon observed by government surveyor J.J. McArthur:

> It is a matter of regret that fires incidental to the railway construction have devastated much of the country in the vicinity of the railroad, and have spoiled much of the wonderful beauty the environs of these mountains (Dept. of Interior Annual Report for 1886).

W.F. Whitcher, a Department of Interior official sent by the minister in 1886 to "report on the kinds and condition of game and fish in the Canadian National Park at Banff" recognized the threat from forest fires to the then small park and recommended the construction of dams near the mouth of Sundance Creek, west of the hot springs. These dams would provide habitat for waterfowl and...

> would be invaluable as a fire-break against any conflagration from the west.... Without some such effective break any fire under headway from the westward must inevitably consume the fallen and standing timber, and all the tangled undergrowth west of Banff, and also imperil the railway. It would creep up the timbered gullies and overspread the mountain slopes. Indeed, the entire settlement down to Tunnel Hill would be endangered. A windy fire might altogether defy subduing, and would certainly disfigure and probably destroy the finest and most useful portions of natural scenery in the very heart of the National Park (Dept. of Interior Annual Report for 1886).

Whitcher's fear of a fire sweeping into the park from the west was to be justified several times over the next 20 years.

The abundance of recently burned areas, whether ignited by lightning, natives, or Europeans, made an unfavourable impression on many of Banff's first tourists who were conditioned to the more cultured landscapes of eastern North America and Europe (Barneby 1889).

Appreciative of tourists' preferences, the park's first Superintendent, G.A. Stewart, commented:

> In past years forest fires have ravished portions of the Park and left spots of desolation and extensive bands of dead timber, disfiguring the natural beauties of certain tracts. A quantity of this dead timber has been cleared off since the commencement of the works here and much of it made into firewood and sold.
>
> During the past summer the Park has escaped fires partly owing to the clearing out of new roads, but principally in consequence of the quantity of rain that fell during the season.

> Each new road opened forms to some extent a fire break and it is hoped that in time the spread of fires will be much more easily prevented (Dept. of Interior Annual Report for 1888).

Stewart's efforts were timely, for in 1889 the Rocky Mountains experienced a serious fire season, expansive areas burning in the Jasper area (Tande 1979) and Montana (Arno 1976; Gabriel 1976). Two fires caused concern on Rocky Mountains (Banff) Park's western boundary, which at that time was near Sundance Creek (Fig. 5).

> Early in May a fire occurred in the hay marshes on the south and west of the Bow River which for a time appeared very serious, but through the exertion of the men on the works, the inhabitants of the place, and the favorable change of the wind, no damage was done further than the scorching of some ornamental trees in that portion of the park, but which, however, was of sufficient importance to cause great regret that these fires should occur, and their causes remain so difficult to ascertain.
>
> During the month of June very extensive fires were seen coming towards the park from the west, and in due time they approached the boundary. No human efforts could avail to arrest the flames while they surged through the heavy pine timber beyond the limits of the park, on the north-west side, but the bare summits of the mountains, which form that boundary, were effectual in arresting their progress, notwithstanding the terrific fury of their approach.
>
> All that could be done under these circumstances was to watch carefully for the sparks and masses of burning wood carried by the wind over the mountain peaks, and falling thousands of feet from their source.
>
> All the men on the works had to be taken off to fight this demon, and the inhabitants were warned out to assist for days in cutting out fire breaks and preventing the spread of these fires down into the valleys of the park; at last success crowned our efforts, with comparatively little damage to the park, but considerable destruction to the adjoining timber limits.
>
> The fires this season have been the most destructive known for many years, and now that they are over it is satisfactory to know that as regards the track of the fire this year we can hardly be visited from the same quarter for some time to come (Dept. of Interior Annual Report for 1889).

Fire scar and stand origin analyses indicate that the June 1889 fire burned along the Bow River near the mouth of Healy Creek before turning northwards – passing over Edith Pass and Elk Lake summit into the Cascade Valley. A large portion of the Cascade Valley was burnt out south of Cuthead Creek (Hamer and Herrero 1983), including the valley of Stoney Creek. The smoke from this fire and others caused some interest in Calgary, as the following reports from the *Calgary Herald* illustrate:

> Heavy fires are raging in the mountains this side of Palliser station (19 June 1889).

> When a light wind sprung up from the west yesterday afternoon the town soon became enveloped in smoke from the fires in the mountains, so that it was dark enough for artificial light three hours before the usual time (19 June 1889).
>
> Dr. R.G. Brett, MLA of Banff, is in town. He says that although large fires have been burning in the mountains in the neighborhood of the National Park, yet there is no immediate danger threatening the town (26 June 1889).

The fires of 1889 further encouraged Stewart to continue his construction of trails and roads for fire protection purposes.

1890-99

The decade from 1890 to 1899 was one of numerous large fires in what is now BNP, yet few fires occurred within the boundaries of what was then Rocky Mountains Park (Fig. 5). Thus Superintendents' reports for the period make little mention of fires close to Banff townsite, while often commenting on smoke-obscured skies. Figure 9 shows burn locations for the 1890-99 period, which are summarized in Table 4. Most of this information is based upon fire scar and stand origin analyses.

1890-95: Four Major Fires

The 1890 fire season was a welcome change from 1889 for Superintendent Stewart. Because of a late spring and cool, showery summer, there was little trouble from forest fires.

In 1891 a dry spring (Fig. 10) favoured the spreading of a fire down the Bow Valley towards the park boundary in the latter part of May.

> This fire originated on the railway track to the west of the Park, but spread eastward to the Vermilion Lakes destroying a large quantity of the beautiful natural shrubbery in that direction.
>
> All the men in the Government employ were turned out and the fire was after much exertion stopped and finally subdued at a point about half a mile west of the Cave. It was this and previous fires that induced me to urge on the construction of the Sundance Avenue to form a fire break at the narrow pass between the Bow River and the base rocky shoulder of Sulphur Mountain (Dept. of Interior Annual Report for 1891).

The 1891 fire in the lower Bow Valley burned in the same area as part of the big fire of 1889; thus it is difficult to delimit its boundaries although it appears that the fire burned some 7000 ha, mainly on the south-facing montane slopes between Castle Junction and Vermilion Lakes. Superintendent Stewart was aware the railroad was the probable cause of this and other fires (Dept. of Interior Annual Report for 1891).

Stand history analysis reveals another fire of approximately 2500 ha

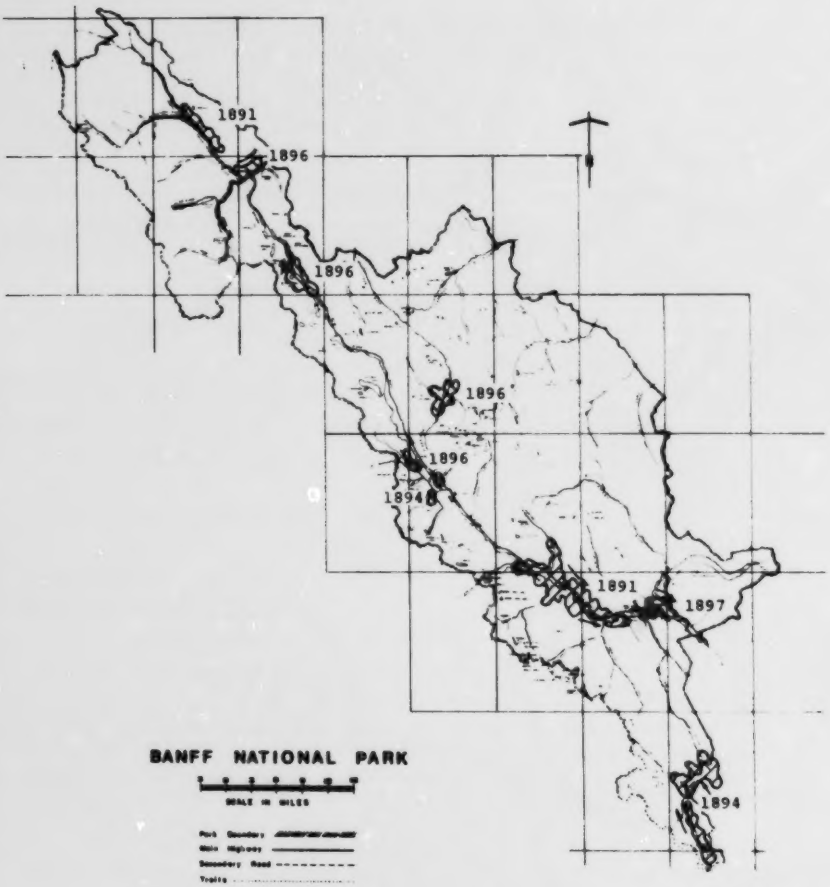


Fig. 9. Location of Banff National Park fires (1890-99).

that burned along the North Saskatchewan River in about 1891.

The summer of 1892 saw no serious fires in the area due to showery weather and in 1893 Superintendent Stewart reported only minor fires (Dept. of Interior Annual Report for 1893) despite a dry summer (Fig. 10).

For 1894 Stewart recorded:

> No extensive fires occurred within the park. Two or three small local fires were started by some careless or malicious persons, but were discovered in time to be extinguished before they had a chance to spread.

Table 4. Banff National Park fires (1890-99)

Year	Date	Location	Area burned (ha)	Cause	Reference
1891	20-30 May	Lower Bow Valley Johnston Canyon to Sundance Cr.	7400	Railroad?	Dept. Int. Reports
1891		North Saskatchewan River	2500	Unknown	Stand analysis
1894	9 Aug.	Paradise Valley	150	Campers	Wilcox 1900
1894		Upper Spray River	2900	Unknown	Ritchie 1915
1896		Bath Creek (Lake Louise area)	1050	Railroad?	Stand analysis
1896		Lake Louise	150	Railroad?	Stand analysis
1896	1-15 Aug.	Mistaya River	950	Prospectors?	Wilcox 1900
1896		Saskatchewan Crossing	1300	Unknown	Stand analysis
1896		Molar Creek - Pipestone River	1200	Unknown	Stand analysis
1897	13-15 Sept.	Anthracite	1000	Unknown	Dept. Int. Reports

> Notwithstanding this fact, the park was enveloped in smoke for some weeks, caused by distant fires which was very disagreeable and disappointing to visitors and sight-seers (Dept. of Interior Annual Report for 1894).

This smoke may have come partially from a fire described by Ritchie (ca. 1915) as crossing over Palliser Pass into the upper Spray in 1894. Fire scar and stand age analyses substantiate that over 3000 ha of this valley burned in the early 1890s. An additional area of approximately 150 ha burned in August of 1896 in Paradise Valley, near Lake Louise. As Wilcox (1900) describes, the fire may have originated from a campfire used by two benighted climbers on the night of 2 August.

> A week later, little column of smoke was seen rising from the woods towards the east, and from Laggan it was reported that a large area of the forest was on fire. Some pointed the finger of scorn at us and held our party responsible. William Twin, our Indian friend, said, 'Me think two white men light him fire,' to which we replied that this was impossible as the fire had broken out nearly a week after our visit. William then met our arguments with this sarcastic fling: 'Oh no, white man no light fire. Me think sun light him.'

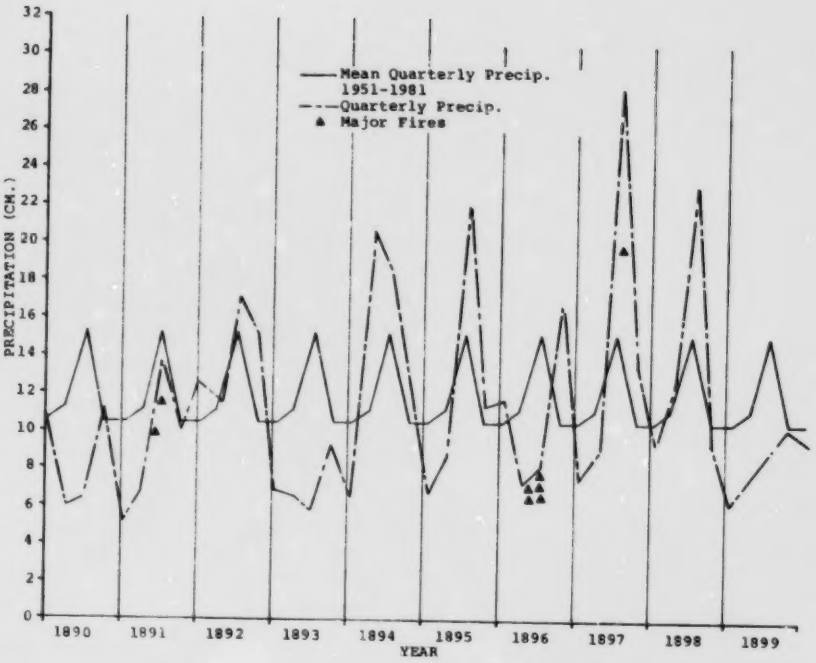


Fig. 10. Total quarterly precipitation for Banff weather station (1890-99).

A gang of section men was dispatched from Laggan to fight the fire, which did not prove serious and was extinguished in 2 days.

In 1895 no significant fires were reported for the area local to Banff townsite.

1896: Probably Many Fires

The year of 1896 apparently saw widespread burning in the Canadian Rockies, but the small area of Rocky Mountains Park was again spared from fires (Dept. of Interior Annual Report for 1896.)

Elsewhere within the Banff Park boundaries of today, several fires occurred. In August Walter Wilcox's expedition north over Bow Pass, with guides Tom Lusk and Fred Stephens, encountered a large fire in the Mistaya Valley. The following passage from Wilcox's (1900) *The Rockies of Canada* gives an account of this rather unusual hazard of backcountry travel, and is an example of Wilcox's excellent ability to observe the park's natural environment.

The success of our expedition now seemed imperilled by an unfortunate circumstance. From our elevated position on the summit of this pass we saw that a very extensive forest fire was raging some miles down the valley. The fire had started in the middle of a heavily timbered valley twenty-five miles long. Clouds of smoke were sweeping up the mountain slopes under the influence of a strong wind, and at night we saw a ruddy glow with sparkling lights like the innumerable camp-fires of an invading army. Should we venture to cross the lines of this dangerous enemy and compel a passage through his forces? Far into the night, grouped round our camp-fire, we discussed how fast the flames might travel, and what line of retreat we should adopt in an emergency. Having decided at length to take our chances of getting through, we descended next day into the valley.

Further investigation showed that it was possible to get our horses through the fire, which had spent its energy on a large extent of green timber; so after three hours' travel from camp we came to the burning trees, where the fire was advancing slowly, as there was a calm. Then came several miles of the recently burned area, now changed to a forest of blackened sticks, some of which were already fallen, with here and there a column of smoke rising from smouldering moss, and everything half concealed in a snowy covering of ashes. At the other edge of the fire there was more danger, and frequently some tree would flash up and send a scorching heat toward us. We were chiefly anxious that the packs should not take fire and cause a stampede among the horses; so for a considerable distance we drove our animals along the edge of a lake and frequently waded deep in the water to avoid the heat of blazing trees.

After an exhausting march of six hours we made our camp in a muskeg, or swamp, about half a mile from the fire. The wind, however, which had been increasing for a time, began to carry the fire toward us, and our situation soon becaming alarming when some heavy timber began to blaze and the columns of flame, shooting hundreds of feet into the air, made a terrifying roar, which caused our horses to stop feeding. At one time a funnel-shaped whirlwind about two hundred feet high formed over the heated area and remained there a few moments.

At the rate of progress the fire was making, we should soon have been surrounded had we not packed up and moved a mile farther down the valley. The second camp was made by the side of a considerable stream, wide enough to stop the fire; but toward evening cloud banners began to form at the peaks of the mountains, and next day, after many weeks of drought, rain fell steadily for ten hours and fortunately extinguished for a time the fires that were destroying this beautiful valley.

Forest fires usually progress slowly, the moss and underbrush carrying the fire along from one tree to another. As the fire catches among the dry branches of a fresh tree it sweeps rapidly upward with a loud roar and sends a sheet of flames one hundred and fifty or two hundred feet into the air for two or three minutes.

After the branches and foliage have been consumed the fire smoulders for a long time. In light forests and a calm atmosphere such fires are not very dangerous, but where the trees are close and a high wind prevails, the flames leap from tree to tree in great tongues of flame. Sparks and brands carried heavenward by a furious draught, created in great part by the fire itself, start the flames in a thousand new places in advance of the main column and accelerate its terrible speed. Clouds of dense smoke and blasts of air, like the breath of a furnace, precede the flame and wither up the green vegetation in preparation for its burning. Fires sometimes travel forty or fifty miles an hour, and from them there is no escape for any living thing – man, the wild animals, and even birds all perishing together. Though the forests have been more frequently burned since the arrival of white men, there are abundant proofs that fires occurred even before primitive man came among them. Traces of charcoal often appear where old trees have been uprooted by storm in a virgin forest. Charcoal may be found under the roots of trees near Lake Louise, some of which by actual count of their rings are three or four centuries old. I discovered a gravel bank near the station of Cascade, a few miles from Banff, which gave evidence of prehistoric forest fires. The river has cut under the bank and left a vertical face of clay and gravel, in which there are several thin layers of charcoal fragments, and under each a band of clay and gravel turned red by heat. These ancient fires were no doubt, as is often the case nowadays, started by lightning. After the forests have been burned over, the trees begin to fall and soon make hopeless obstacles to travel. A crop of purple fireweed, raspberries, willows, and other deciduous bushes springs up in a year or two in the dead timber. Young trees also appear very soon, sometimes growing spontaneously throughout the burnt tract.

In addition to the fire in the Mistaya Valley, fire scar and stand origin analyses have revealed several other areas that burned in Banff Park around 1896 including 1300 ha near Saskatchewan Crossing, 1200 ha along Molar Creek and the Pipestone River, 1000 ha near Bath Creek, and 150 ha east of Lake Louise village. The dry conditions of the spring and summer quarters of 1896 (Fig. 10) further support the conclusion that these areas burned that year.

1897-99: Fire and Floods

The federal election of 1896 brought down the Conservatives and shortly thereafter "Superintendent Stewart's services were dispensed with"; a well-known Liberal, Howard Douglas, was named as Rocky Mountains Park's new chief (Byrne 1964).

The village of Banff had another close call with a fire during Douglas' first year on the job (Dept. of Interior Annual Report for 1897). Trees scarred from this fire reveal that some 1000 ha burned in the area of the Indian Grounds, Tunnel Mountain Campground, and the Hoodoos. The

latter years of the 1890s had wet summers (Fig. 10) with no other fires of consequence apparent.

Although fires may have given few problems during these years another natural event did much damage – floods on the Bow River (Nelson and Byrne 1966).

> During recent years much of the heavy timber which covered the sides of the mountains has been burnt off, and when the cloud burst between the Gap and Castle Mountain, the steep slopes of the mountains and foothills became chutes along which the floods rushed, swelling the rivers and valleys into a wild torrent of seething, escalating waters *(Calgary Herald,* 21 June 1897).

This realization of a potential link between the forest cover of the mountains and the river waters of the prairies provided strong incentives for the development of government agencies in subsequent years to protect the eastern slopes of the Rockies.

1900-09

The early years of the 20th century were ones of extreme fire activity in many parts of North America, which stimulated the initial organization of many of today's fire protection and management agencies (Brown and Davis 1973). From 1900 to 1909 at least 11 fires over 40 ha burned in today's Banff Park (Fig. 11), with over 15 000 ha burned. Most fires burned in the Bow Valley, and many were probably started by the railroad. Quarterly precipitation (Fig. 12) was below average in several years at Banff townsite, although no exceptional droughts are evident.

1900-02: Carrot Creek and Glacier Lake

A fire in the montane zone near Carrot Creek is described by Superintendent Douglas in his annual report for the year 1900.

> The park has been fairly exempt from forest fires this year; on the second of May a fire was reported ten miles east of the village just within the park limits. It burned over a piece of country about one mile square, covered with pine and poplar groves. A detail of mounted police and the men on the government works were sent out at once, but fortunately rain came and continued for several days, extinguishing it, and rendering no work necessary other than a careful watch for a few days. The origin of the fire was in all probability from a passing train as its starting point was within a short distance from the track (Dept. of Interior Annual Rep. for 1900).

The precipitation records for 1901 (Fig. 12) show that total summer and fall precipitation was below average, yet light showers must have occurred regularly.

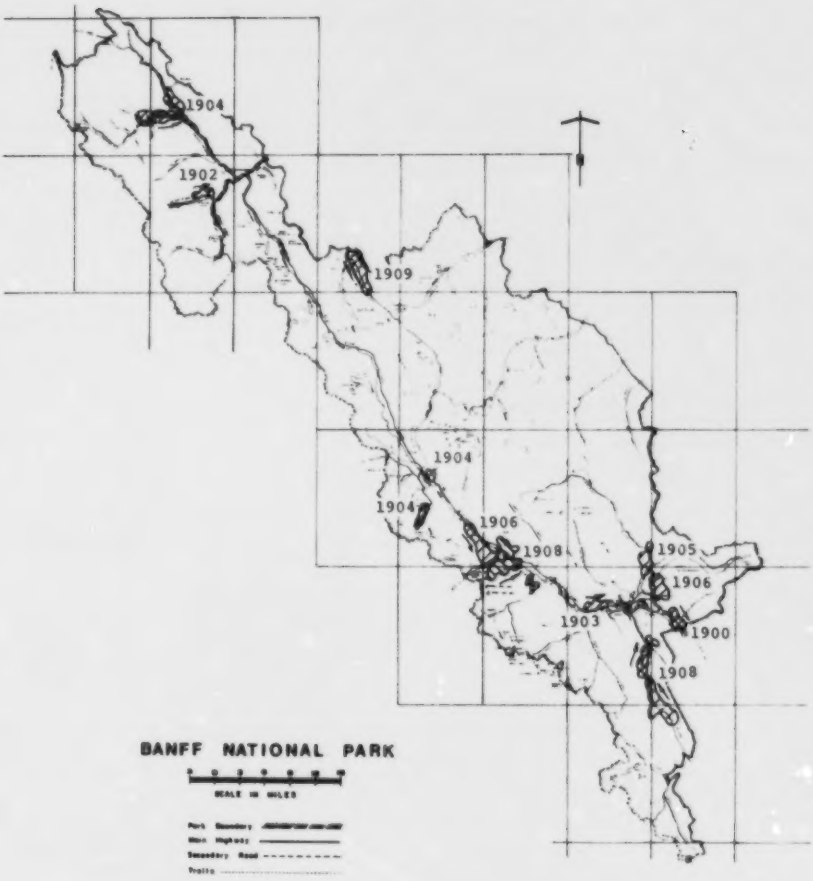


Fig. 11. Location of Banff National Park fires (1900-09).

No extensive fires occurred within the park. The spring was late, and the frequent showers of snow and rain prevented the possibility of any large fires. Two or three small local fires were started, but were discovered in time to be extinguished before they had a chance to spread (Dept. of Interior Annual Report for 1901).

Although no evidence for large fires (over 40 ha) in Bow Valley exists for 1902, further north the Stutfield and Collie climbing and exploration expedition observed a fairly large fire on the east side of Glacier Lake during mid-August.

Table 5. Banff National Park fires (1900-09)

Year	Date	Location	Area burned (ha)	Cause	Reference
1900	3 June	East Gate	250	Railroad	Dept. Int. Reports
1902	1-7 Aug.	Glacier Lake	450	Lightning	Stutfield and Collie 1903
1903	1 June	Mt. Edith	1000	Railroad?	Crag and Canyon
1904		Alexandra River	1500	Unknown	Stand analysis
1904	24-31 July	Moraine Lake	500	Campers?	Crag and Canyon Supt. Reports
1904	3 Aug.	Lake Louise	200	Railroad?	Dept. Int. Reports
1905	10-12 May	Bankhead	700	Mining operations	Crag and Canyon
1906	5 July	Eldon	1500	Railroad?	Crag and Canyon
1906	1-7 July	Anthracite	900	Settlement?	Crag and Canyon
1908	23 July	Spray River	3100	Unknown	Crag and Canyon
1908	10 Aug.	Castle Junction	5000	Lightning?	Crag and Canyon
1909	21-26 Aug.	Siffleur River	1750	Lightning?	Crag and Canyon Stand analysis

It had been our intention to journey straight from Howse Peak to Glacier Lake, but the fire that was evidently raging in the valley of the latter made a preliminary inspection desirable. We therefore pitched the tents on our previous camping-ground nearly opposite the mouth of the Glacier Lake stream, and in the afternoon Fred, Stutfield, and Weed rode across the Saskatchewan to the lake. The fire was burning merrily at the further end, and the forest at the water's edge was belching forth big columns of dun-coloured smoke, while smaller patches of brushwood were ablaze higher up the mountain-side. The woods at the nearer end were as yet quite untouched by the fire; so on the following day we moved the outfit over the river up to the lake.

The rain of the previous day had somewhat quenched its ardour, but with a renewal of the fine weather it was preparing for a fresh start. The still damp underbrush was smouldering, the fire now dying away, now suddenly rising again. Occasionally great tongues and jets of flame would shoot skywards, as some clump of extra dry timber got ablaze; and, with a mightly crackling, thousands of sparks and red-hot pieces of wood flew up, followed by immense slowly-rising pillars of smoke that expanded, umbrella-like, towards the top; and, lit by the rays of the declining sun, gradually enveloped

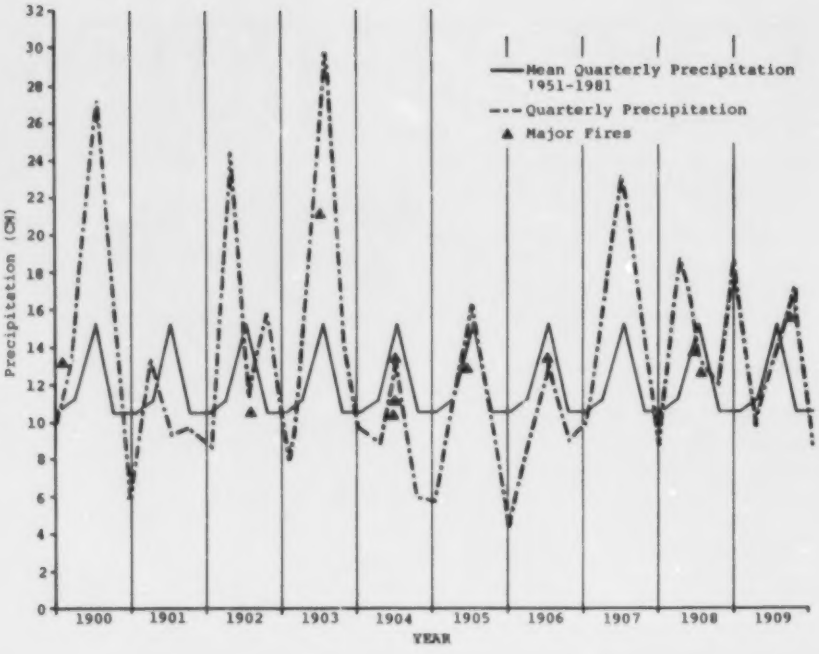


Fig. 12. Total quarterly precipitation for Banff weather station (1900-09).

> the surrounding peaks with a lurid haze. The fire had not, as yet, embraced any one large expanse of wood; but it was slowly eating its way like a pestilence eastwards in small scattered patches which gradually united, and, if the fine weather continued, it was evident that wide tracts of the neighbouring forests would be destroyed (Stutfield and Collie 1903).

The maximum extent of the 1902 Glacier Lake fire is not known, but it does not appear to have burned into the main Howse River Valley.

1903: Another Close Call for Banff Townsite

The 1903 fire season started early. The fire in the spring of that year was the fourth within 15 years to threaten the village seriously.

> In May 1903, a very serious fire was located about three miles west of Banff station, on the north side of the railway, and it burned

CRAG AND CANYON.

VOL. 4 BANFF, ALTA., CANADA, JUNE 6, 1903. NO 6.

FOUGHT FIERCE FIRE.

A little puff of smoke, as if from the starting of a big locomotive, shot up through the clear and warm atmosphere of last Sunday afternoon, and fifteen minutes later Constable Blythe had spread a general alarm through the village. The male population responded promptly, and in a few minutes a large army of volunteer fire fighters, armed with shovels and axes, was hurrying in the direction of the scene.

The volume of smoke rapidly became larger and soon flames were leaping in many directions.

The alarm was sent east and west over the C. P. R. system for some distance, and section gangs were immediately turned out.

The fire was located three miles west of Mount Edythe pass, six miles west of Banff, the origin having apparently been close to the railway.

Arriving at the scene the Banff contingent commenced and, for four hours, energetically pursued the work of cutting down trees, removing dry brush and throwing up dirt. They succeeded in checking the spread of the flames in the direction of the track, allowing them to run north, up the mountain side towards the snow limit.

There was still a danger of the fire spreading through dry crevices eastward and turning down towards the village, so the C. P. R. men were dispatched to different points to dig washouts and perform other work of prevention.

All night the hill sides to the northwest were fiercely illuminated, but the course of the flames was kept under control, and the next morning the village was in no danger. Within the confines the fire burned for three days.

APPROACH TO FIELD ON THE C. P. R.

Though no serious damage was done an evidence of the possibility of a great calamity to the park was plainly presented, and the necessity of better fire protection and more precaution somewhere spoke for itself.

In this case it is hard to limit the extent of disaster averted by the prompt action and clever generalship of Constable Blythe and the energetic efforts of willing citizens.

Fig. 13. *Crag and Canyon* account of the 1903 Mt. Cory fire.

fiercely for two or three days. Much time and labour were lost in battling with the flames, and all the men on the works, assisted by a large force of railway employees, worked faithfully day and night to subdue the fire. Fortunately a welcome rain came the third day,

and the fire was got under control. ... (Dept. of Interior Annual Report for 1903).

Banff's young newspaper, the *Crag and Canyon*, headlined the fire (Fig. 13). Probably about 500-1000 ha were burned on the sides of Mt. Cory and Mt. Edith.

1904: Smoke Everywhere

In 1904 large forest fires burned many areas of the northern Rocky Mountains. The *Calgary Herald* of that summer records that Wallace, Idaho, was threatened and large areas of Montana were burning on 27 July. Nelson, B.C., was surrounded by fire on 13 August. Creston, B.C., was nearly burned on 18 August and on 23 August the Crowsnest fires that had been burning all summer were extinguished by snow. Idaho Falls and Boise, Idaho, burned in forest fires on 15 September. In Kananaskis Provincial Park, Hawkes (1979) dated to 1904 a fire that burned out the Smith-Dorien Valley. In Yoho National Park a fire along the railroad blackened a large area of young timber (Dept. of Interior Annual Report for 1904).

Fires in Rocky Mountains (Banff) Park in 1904 caused a host of problems for Superintendent Douglas. On 4 August he wrote the following letter to J.A. Smart, Deputy Minister of the Interior:

> Dear Mr. Smart:
>
> I regret to have to report that we have had some very serious fires in the park recently.
>
> About ten days ago a fire was located in the eastern portion near Morley, and along the railway. I had 10 men at work for three days and nights, and the Railway Company had an equal number. They managed to get it under control until a rain came and it is now safe.
>
> At the same time we had another within two miles of the Village of Banff adjoining the Animal Enclosure. This was quickly got under control but I kept a night and day watch for a week until the rain came. During the same period the most serious of all started near the Chalet at Laggan. This was no doubt done by campers as it was five miles from the Railway. We had all the men from Field and Laggan, about 36 all told, and the CPR sent in 50 more and they were there for four days and nights attempting to prevent it from reaching the Chalet at Lake Louise. All meals and supplies had to be sent in by pack horses eight miles, as you can quite understand it was a trying time to keep them in feed and etc. We managed to confine it to an area of about two miles in length by three quarter miles in width and it is now quite under control, although it destroyed a most beautiful piece of scenery along the shores of Moraine Lake. This was called Paradise Valley and was one of the beauty spots in the Mountains, and it is the intention of the CPR to build a Chalet there next year. It is my intention to build a carriage road to this point providing my estimates have all passed.
>
> We had a shower of rain a few nights ago and at present all our

fires are quite under control, although I fear that if the dry season we are threatened with continues that our whole time will be expended fighting fires.

The cost in connection with fires for the last two weeks will be about $700.00. I do not know whether the CPR will charge for men they sent to the Moraine Lake fire, for it was certainly not started by an engine. I purchased supplies and forwarded the bill for all the sum, there were no stoves or camps so had to send in canned meats, bread and tea etc., and I presume we will have to pay for all the supplies as well as for pack and saddle horses getting men and supplies in.

I am Sir,
Your obedient servant,
Howard Douglas,
Superintendent

(Letter on file, Archives of the Canadian Rockies.)

The *Crag and Canyon* of 30 July also provided information on these fires.

The fire at Moraine Lake apparently started north of the lake, burning eastward over approximately 500 ha of the south slopes of Mt. Temple. Superintendent Douglas recognized the danger from fires started by the railroad during dry years, and on 8 August, after a fire broke out along the railroad, he wrote to J.S. Dennis (a senior official for the railroad in Calgary) in regards to starting railroad fire patrols (letter on file, Archives of the Canadian Rockies).

The Alexandra River Valley, then outside the park (Fig. 5), also burned in approximately 1904. Although the exact dates and ignition source are not known, fire scars indicate that nearly 1500 ha burned, including portions of the main North Saskatchewan Valley (Fig. 11).

1903: Fires at Bankhead

The Canadian Pacific Railroad developed a coal mine on the road to Minnewanka which opened for production in 1904. A major fire, probably started by the development activity, burned northwards from Bankhead.

For the past ten days Banff has been surrounded by clouds of smoke from a forest fire which has been raging in Cascade valley, west of Bankhead. Considerable damage has been done to the timber, and two bridges near the six mile board on the road to Devil's Lake have been destroyed, but will be quickly replaced, as otherwise driving will be unsafe on this road. The fire seems to have originated on lands leased to the CPR, and if proper steps had been promptly taken by the authorities at the mines the outbreak might have been checked. A fireguard certainly was cut, but no proper watch being kept in the night the fire leaped across, and on Sunday the NWM Police, with a number of helpers, were kept busy all day fighting the flames, which had then attacked the Park timber. They succeeded

in stopping the advance of the fire, which was completely extinguished on Tuesday (*Crag and Canyon*, 13 May 1905).

The 1905 fire probably burned almost 1500 ha in the lower Cascade Valley, much of which had been burnt 25-30 years earlier.

1906: More Bad Fires

The *Crag and Canyon* of 7 July 1906 described a fire along the railroad just west of Castle Mountain.

> A serious wood fire has been taxing the resources of the Park fire guardians during the last three days. The outbreak is near Eldon and the fire crossed the river to the south side. Will Saddington's crew tried to cross the Bow on a raft to check this, but were all washed off by the rapids, though being good swimmers all got ashore. Extra fire crews from the Gap, and a boat, were sent up last night.

On 11 August the *Crag and Canyon* reported more fires.

> A number of forest fires have broken in this district lately, owing largely to the hot and dry weather. A serious outbreak at Anthracite is now giving much trouble, and if a strong north wind should rise Banff would be in some danger. A fresh outbreak at Sawback was reported last night.

Fire scar and stand origin analyses indicate that probably about 1500 ha of the Bow Valley floor northwest of Castle Junction was burned by the Eldon Fire. The fire at Anthracite appears to have burned approximately 900 ha in the Johnson and Two Jack Lakes' areas.

The fire year of 1906 strengthened Douglas' belief that temporary fire guardians and emergency crews could not deal effectively with the problem. In his annual report he recommended that funds be appropriated for firefighting.

> At present, even with the greatest vigilance, it is impossible to prevent fires from spreading, and the cost of detecting and suppressing these fires has during the past year been one of my heaviest items of expenditure for which no provision has been made. I would respectfully suggest that a sum of money be appropriated during the present year to meet contingencies of this kind as it is hard to say what we may be called on to expend at any time should we meet with a continuance of dry seasons (Dept. of Interior Annual Report for 1906).

1907: A Brief Respite

After 4 years of large fires in the park, the residents of Banff were understandably edgy as the summer of 1907 approached. No serious fires

CRAG and CANYON.

Vol. 8. BANFF, ALTA., SATURDAY, MAY 18, 1907. No. 3

Our Forest Fires.

Mostly caused by C.P.R. Engines.

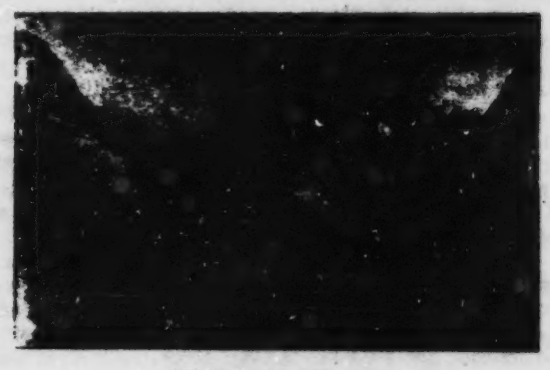
THE beauty and usefulness of the National Park is threatened by the indifference of a corporation whose interests lie entirely in the preservation of the natural beauties of this magnificent domain. We refer to the continually occurring and destructive fires that are a continual menace to our forests. These fires in nine cases out of ten originate on the right of way of the C.P.R., to whom the tourist travel is a no inconsiderable dividend producing factor.

As was noted in our columns last week, a large and destructive fire was only averted by a providential change in the weather, and its commencement followed close on the passing of the westbound train of May 7. Last year the devastating fires which raged near Laggan and in the hills around Anthracite were both started by the railway, and it is high time that some measures were taken to force this powerful corporation to take measures that will at least reduce the chances of having the whole Park laid waste.

It is four years since the Crag and Canyon had an interesting fight on over the same question, and it seems as if it was necessary to again get in and handle the question without gloves.

Our position in the matter is not one of antagonism to the C.P.R.; but why should any man, or combination of men be allowed to disregard the law and do infinite damage to the forests, with the accompanying evils of destruction of game and disturbance of drainage which follow these fires, without let or hindrance.

The Dominion laws provide that all engines shall be equipped with effective screens in both smoke stack and ash-pans to prevent the setting of fires, and we want to know why this law is not enforced. No system of fire wardens short of having a man follow each train and engine can successfully cope with the evil as things are now. A short half hour is sufficient to let any fire under favourable conditions get a headway that cannot be checked until it has done incalculable damage, and, instead of assisting the Government officials by reporting and checking the fires, the railway seems to regard them with indifference.



CANADIAN NATIONAL PARK, BANFF.

Fig. 14. *Crag and Canyon* report on fire problems of 1907.

occurred that year, although on 18 May 1907 the *Crag and Canyon* (Fig. 14) illustrated the citizens' concern of the effect of fire on the park's forests and the problem of the railroad. Still, the senior adminis-

tration of the Department of Interior did not react to continued requests from park and forestry officials to employ an adequate staff of fire and game wardens to help prevent fires. However, the conservation movement in Canada was growing; the Dominion Forestry Act was passed in 1906 and the first Canadian Forestry Convention of the same year examined forest protection problems. As Howard Douglas wrote:

> Popular interest, more practical than sentimental, in what ever touches the welfare of the country's forests is growing rapidly, and a hopeful beginning has been made by the Canadian government in real protection for the reservations as well as for all the parks (Dept. of Interior Annual Report for 1907).

1908: The Rockies Burn Again

The forest fires of 1908 are infamous in the Crowsnest Pass region. On Saturday, 1 August, a brewery in Fernie caught fire, and by Monday afternoon the Elk Valley from Fernie to Michel was burned out, the towns of Fernie, Michel, and Hasmer destroyed, and numerous people killed (*Calgary Herald*, 3 August 1908). It was a forest fire of unprecedented tragedy in Western Canada, which further encouraged the conservation movement.

To the north, in Rocky Mountains (Banff) Park severe fires also burned in latter July and early August. "The smoke from a bush fire at the head of Cascade Creek attracted considerable attention on Monday and Tuesday. One man was heard to observe that it was likely to have been started by the 'zoological' survey party" (*Crag and Canyon*, 25 July 1908). The exact location of this fire has not been found.

On 31 July the paper reported on a large fire up the Spray River.

> A fierce fire started on the west side of Goat Mountain on Monday. The rain of Tuesday apparently put it out, but Thursday noon vast clouds of smoke gave evidence of its having got going again.
>
> Supt. Hunter left on Friday for the scene of the fire to note its exact location and extent.
>
> As far as can be judged, the upper Eau Claire camp and a large portion of their timber has been destroyed. The fire is burning both sides of the river (*Crag and Canyon*, 31 July 1908).

The 1908 Spray River fire burned northwards from below Goat Pass, eventually covering approximately 300 ha. The fire was still burning on 8 August.

> A number of guests at the CPR hotel got into a panic last Sunday, when dense clouds of smoke rose from Goat Mountain, due to the fire running up the slope of the mountain facing town. Several residents of Banff were also on edge, and have had to stand a good deal of "joshing" since, on account of their unreasoning fears (*Crag and Canyon*, 15 August 1908).

Also on 15 August the paper reported the Castle Mountain fire along the Bow west of Banff.

> **Castle Mountain Fire**
>
> A fire which started near Castle Mountain last week, and which was nearly put out by Sunday morning, leaped all barriers in the afternoon, and in 1 1/2 hours had raced over eight miles of country. The CPR rushed extra gangs to the spot, and boats and supplies were sent up from Banff on a special train Sunday evening. On Tuesday Mr. Douglas went west, and found that the men had things under control. This last fire is supposed to have started from the camp fire of a party that passed through that district last week (*Crag and Canyon*, 15 August 1908).

This fire apparently started below Storm Mountain (near Twin Lakes) and fanned out to the east, crossing the Bow River and climbing the slopes of Castle Mountain. Approximately 5000 ha burned.

By 1908 the seriousness of fires in the Rocky Mountains was apparent to all. Parliament placed the Dominion Parks under the jurisdiction of the Forestry Branch and designated funds specifically for preservation of the park's timber and game. In his report for 1908, Howard Douglas describes the creation of the Warden Service.

> At the last session of parliament provision was made for the employment of three game and fire wardens and for combining the duties in connection with the protection of game and the prevention of forest fires in the Rocky Mountains Parks. These appointments have been made and the new wardens will enter on their duties with the beginning of the fiscal year.
>
> They will patrol all portions of the parks and regular patrol trails and small cabins will be constructed in different portions of the parks where the men can remain over night and avoid the necessity of packing tents, &c., with them. Each will be furnished with a saddle pony and a pack pony carrying supplies, so that they can remain out for several days at a time or as long as their patrol duty in any locality may require....
>
> The question of the prevention of forest fires in the parks is also very serious, and one which causes a great deal of anxiety, especially during the dry months of July and August. During the past year the expense in connection with fighting forest fires was much greater than in former years, but this additional expense was counterbalanced many times over by the saving from destruction of large quantities of fine valuable timber. The instituting of a systematic patrol and the adoption of more stringent regulations in respect to the care of camp-fires by tourists should have the effect of greatly reducing the danger from this source and assist us in the effort to preserve the forests of the parks in the state of primeval nature which is one of their chief charms (Dept. of Interior Annual Report for 1908).

1909: Possible Fire in the Siffleur Valley

Fires put the newly formed Warden Service straight to work in 1909. The fires reported in the *Crag and Canyon* have not been exactly located, although one possible location could be the Siffleur Valley where fire scar and stand origin analyses reveal that some 1700 ha burned around 1909 or 1910. This fire moved northwards down the valley, burning up today's park boundary.

In 1909 Howard Douglas made the following comments on the performance of the fledgling Warden Service.

> Since we have inaugurated our new plan of fire and game guarding by the appointment of a competent staff of experienced men under the direction of a chief, the fires have been less frequent and have done less damage than ever before. These men have looked carefully after the piling of limbs and brush on areas granted to numerous parties for the cutting of cordwood, mine props and lumber, and if this system of protecting the forest from chance of fire is continued, it is only a question of a few years when we will have but one place where our men will have to exercise their constant vigilance, namely, the railway right-of-way.
>
> The regulation governing the starting of camp fires, &c., is having the effect desired and I am pleased to state that the residents in the park are commencing to take a keen interest in safeguarding the forests from fire. I might also mention that the government's cooperation and assistance in this regard are greatly appreciated. The staff of forest guardians is without a doubt the most important we have, as so much depends on them to maintain and perpetuate the beauty of the park and protect the game (Dept. of Interior Annual Report for 1909).

1910-19

Unlike the previous three decades, 1910 to 1919 saw few large fires within BNP, although elsewhere in the northern Rocky Mountains there were some major fire years. Figure 15 and Table 6 show locations and summarize available information for Banff Park fires. The majority of burned area can be attributed to one fire at Saskatchewan Crossing which fire scar analysis revealed had an approximate burn year of 1910. Quarterly precipitation for the decade (Fig. 16) shows most summers had above average precipitation at Banff station with dry summers in 1914 and 1919.

From 1910 to 1919 the Warden Service expanded from four staff in BNP to an organization of 46 Wardens and 66 cabins throughout the mountain national parks (Department of Interior Annual Reports). The National Park Service also developed the lightweight portable water pump during these years -- which was as Commissioner Harkin claimed "the first practical and successful step ever taken to utilize power pumps for forest protection" (Dept. of Interior Annual Report for 1915). The advent

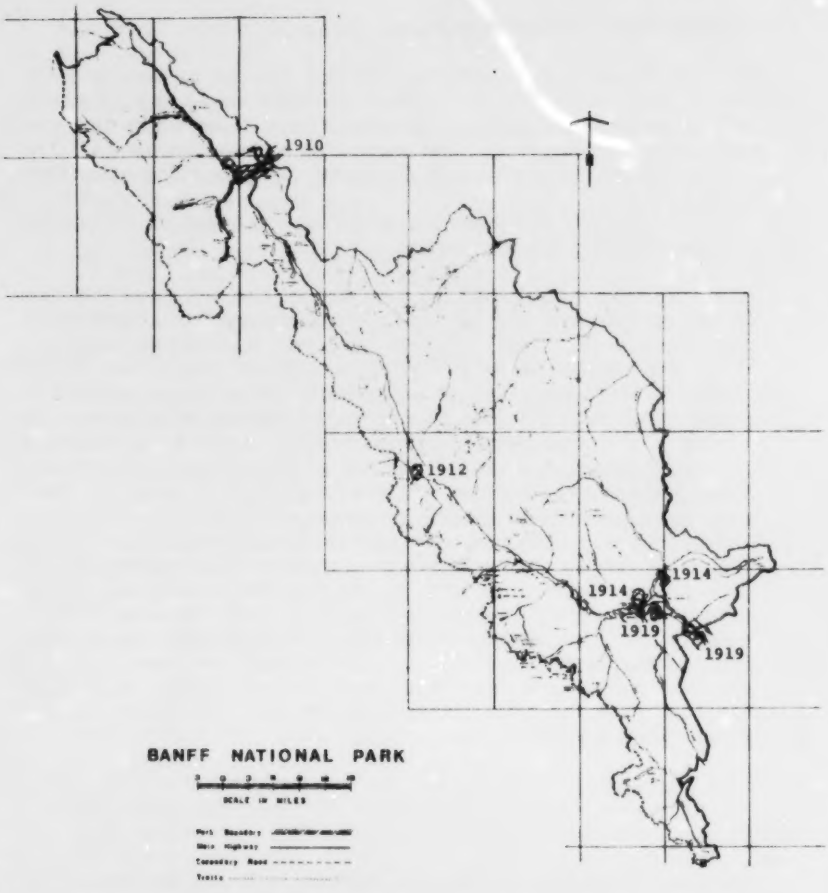


Fig. 15. Location of Banff National Park fires (1910-19).

of the pump is described by Mabel Williams (1936) in her book *Guardians of the Wild.* This piece of equipment revolutionized forest firefighting mechanisms and was soon adopted by forest conservatonists all over the continent.

Other early innovations in firefighting adopted before 1920 by the Warden Service included the experimental use of a fire retardant called Pyrox (Dept. of Interior Annual Report for 1918) and stationing a fire lookout man on top of Sulphur Mountain during dry years to detect fires (Annual Chief Park Warden Report for 1915). The Wardens also undertook

Table 6. Banff National Park fires (1910-19)

Year	Date	Location	Area burned (ha)	Cause	Reference
1910	July/ August	Saskatchewan Crossing	2500	Unknown	Stand analysis
1912	13 June	Chateau Lake Louise	100	Settlement	*Crag and Canyon* Dept. Int. Reports
1914	16 June	Lake Minnewanka	100	Logging	*Crag and Canyon* Dept. Int. Reports
1914		Forty Mile Creek	300	Unknown	Dept. Int. Reports
1919	16 July	Mt. Rundle	100	Settlement	*Crag and Canyon* Dept. Int. Reports
1919	15 July	East Gate	200	Unknown	*Crag and Canyon*

a publicity campaign to prevent man-started fires, placing posters throughout the park.

1910: Big Fires Miss the Park

Probably no year on record excels 1910 for severity of fires in the northern Rocky Mountains. Between 10 and 21 August the great Idaho conflagration composed of some 1700 fires burning simultaneously swept over a million hectares, killing more than 80 people (Holbrook 1943). In the Canadian Rockies the *Calgary Herald* reported large fires on Lineham Creek (Waterton Lakes National Park) on 6 August and near Pincher Creek on 9 August. Although the Bow Valley area apparently was relatively fire-free that summer, the Superintendent's annual report described some close calls with fires in many areas of the park.

> One small fire, if not properly guarded against, can in a short space of time convert our present beautifully wooded park into a black and barren waste, drive our game from the country and leave practically nothing but the bare mountains and streams. Although our game and fire guardians have little else to do in the winter than patrol their regular rounds, they have been constantly on the alert for any fires. They report two fires at the east end of Lake Minnewanka, caused by the negligent campers. One large fire came down from the Brazeau and Ghost rivers to a point near the east end of Lake Minnewanka and we had to send a party of fighters out from here to prevent it getting into the park, which, I am glad to say, was accomplished after considerable work. Our guardians also extinguished deserted camp fires at the mouth of Panther river and on the Bow river, as well as fires of the same nature on the Spray and

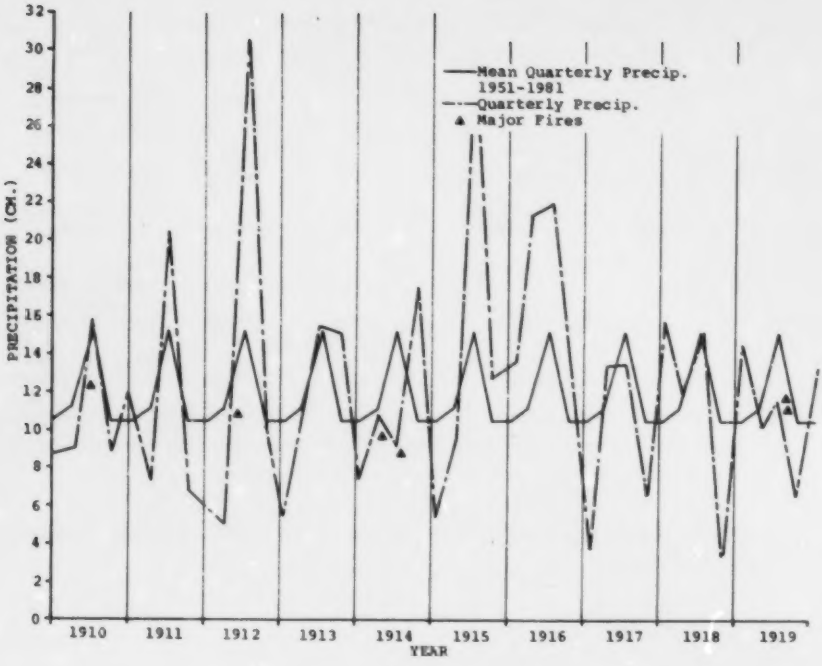


Fig. 16. Total quarterly precipitation for Banff weather station (1910-19).

Kananaskis rivers. This makes a total of seven camp fires extinguished that might have become serious, but when it is understood that there were over twenty large parties of tourists outfitted here during the season, it will be seen that care has been exercised in issuing permits to the men in charge of these parties, as we cannot lay blame of any of these fires to any of the guides, and it is my opinion that they have exercised commendable care in the location of their camp fires and in putting them out before leaving them.

The source of our greatest danger is from locomotives. We had fire guardians making two trips per day on velocipedes between Banff and Laggan, and one between Banff and Canmore. This is a distance of little more than sixty miles, and in that short distance these men extinguished no less than fifteen fires which they claim were in every case started by the sparks from the engines. However, I may say that the Canadian Pacific Railway Company have aided us this year by putting men to work clearing up all the dead trees and brush on the right-of-way, and if this same spirit of cooperation is manifested during the coming season it will greatly reduce the chances of fires catching from the locomotives.

> In addition to the foregoing there was a fire started on the north side of Sulphur mountains in the neighbourhood of the Middle Sulphur Springs, and we had to call out a large force of men before it was finally put out. I have been unable to ascertain the cause of this fire (Dept. of Interior Annual Report for 1910).

Fire scar analysis shows that a 2500-ha area of BNP near Saskatchewan Crossing burned in approximately 1910. This fire burned eastwards into the foothills and may have been part of the massive fire that the Superintendent refers to which burned from the Brazeau River to Lake Minnewanka. J.H. White (in Leavitt 1915) estimated that this and other conflagrations burned a half-million acres (0.2 million ha) during 1910 in the eastern slopes of the Rockies south of the Red Deer River.

1911-18: Quiet Fire Seasons

The years up to and including World War I brought relatively uneventful fire seasons. It was a time of strengthening conservation programs throughout Canada, and the expansion of the Warden Service to patrol the large area of the park. Under the able direction of Chief Park Warden Howard Sibbald, Wardens cut trails, built cabins, and strung phone lines to form a vast network for fire and game protection. By 1919 the system in the mountain parks included the following (Dept. of Interior Annual Report for 1919): 46 Wardens; 66 warden cabins; 256 miles of telephone line; 66 telephones; 25 portable fire pumps; 36 800 feet of hose; 100 fire extinguishers; 14 railroad speeders; and 25 gas masks.

Additional firefighting capability was provided after 1913 when the Board of Railroad Commissioners of Canada ordered the Canadian Pacific Railroad to strengthen its crews along many right-of-ways (Leavitt 1915). In the Laggan Subdivision (Banff and Yoho areas) the Commissioners required:

> Seven men with velocipedes, to be distributed as follows: Between Bow River bridge at mileage 53.2 and Canmore, 14.1 miles; between Canmore and Bankhead, 12.2 miles; between Bankhead and mileage 89, 9.7 miles; between mileage 89 and Castle, 9.7 miles; between Castle and mileage 108, 9.8 miles; between mileage 108 and Laggan, 8.6 miles; between Laggan and Stephen 5.9 miles. Minimum patrol, so far as possible, of two round trips per day, one in the forenoon and one in the afternooon. Between Stephen and Field, 14 miles, one man, to work on foot or ride on pushers as may be most practicable; this patrol to be supplemented by tunnel watchmen and section crews.

A system of fire guards was also begun in 1911 to protect Banff townsite. In the summer of 1911 the *Crag and Canyon* described the work.

> **Fire Protection for Banff Townsite**
> A gang of men are busy cutting a hundred foot fire guard across the

> foot of Sulphur Mountain from the Hotsprings road to Sundance Canyon road, which should be a great protection to the town. The scare last summer from fire on Sulphur showed that we cannot have too many guards and we hope to see the good work continued. During the dry season visitors to Banff cannot be too careful about fire. It is not an unusual thing for parties going out for the day to leave their fire without properly extinguishing it, and the fire may smoulder in the moss for days before breaking out and burning up miles of valuable timber.

Besides the fireguard work, 1911 provided little direct fire work for Wardens, with only two small fires (probably less than 40 ha) occurring near Mt. Edith Pass and at Duthill (Dept. of Interior Annual Report for 1911). In 1912 a dry period in June caused some problems. During the month of June there were 21 fires. The most important one started immediately behind the new Cottage Hotel at Laggan and was probably caused by a workman dropping a lighted match or cigarette end. An area between 200 and 300 acres was burnt. Fifteen fires were started along the Canadian Pacific Railway right-of-way and except for two were extinguished before much damage was done. Four fires occurred while the Calgary Power Company was engaged in clearing at Lake Minnewanka, one burning 10 acres and the others about 1 acre (Dept. of Interior Annual Report for 1912).

In 1913 Superintendent MacDonald complimented the fire patrol work of the railway. "The railway is our most dangerous source of fire; but the Canadian Pacific Railway fire patrol, working in conjunction with our game wardens' patrol, has lessened this danger to a very great extent" (Dept. of Interior Annual Report for 1913).

However, in 1914 the performance of the railroad did not impress the Superintendent.

> Technically, the fire season begins according to the Railway Commission, on the 1st of April each year, when the railway company and our own staff are supposed to put on patrols. This was too early, however, for Rocky Mountains park, but when the dry season did arrive, the patrols did effective work. Indeed the only three fires of the slightest consequence that we had during the year were those which occurred at Lake Minnewanka, on Fortymile creek behind Stoney Squaw mountain, and at the side of the railway near Laggan. This last fire occurred at a time when the railway company's patrol had been taken off by the general superintendent of the Alberta division of the Canadian Pacific railway, without the permission of the Railway Commission. The damage done by the three fires was practically nil, the only real damage being done behind Stoney Squaw mountain, where a quantity of second-growth jack pine was destroyed. We had, however, to keep two or three men at this spot for some weeks in order to make sure that the fire did not get beyond the guard again. Copious rains, occurring about the end of August practically made danger from forest fires negligible.
> (Dept. of Interior Annual Report for 1914)

More information on the 1914 fire at Minnewanka was reported in the *Crag and Canyon* on 20 June 1914.

Although no fires of consequence are known to have occurred in 1915 or 1916, the Superintendent began a vigorous fire prevention program.

> A stock of strikingly effective metal notices, containing a joint warning and appeal in regard to the protection and extinction of fires, was received during the year. At the beginning of the season 600 of the 1,500 received were conspicuously posted all over the park with success, notwithstanding that the season was too wet to thoroughly judge the effect of these notices. They may now be met with on every road and trail in the park and there can be no excuse for carelessness through ignorance, in handling camp fires and smoking accessories. The two picture shows were supplied each with a set of three coloured slides containing equally effective warnings in the same connection, and these are shown on the curtain at every session during the fire season, free of any charge to the department. There was also distributed a large number of brass plates containing a concise warning regarding carelessness by driving and riding parties. This policy of driving home a warning in every possible way cannot fail to be productive of good results. Some thousands of artistically designed wall cards have been distributed and are hung in public places and in the rooms of the various hotels (Dept. of Interior Annual Report for 1915).

The records for 1917 and 1918 show no significant fires.

1919: Dry But Only Small Fires

The summer of 1919 returned dry conditions to southern Alberta, with less than 14 cm of precipitation at the Banff station during the summer months (Fig. 16). Although many fires started in the mountains, the area of today's Banff park missed most of the activity except for several small fires. The following news stories describe the fire situation:

> **Forest Fire at Lake Louise**
>
> Fire broke out within the right-of-way on the CPR main line, about a mile and a half from Lake Louise Tuesday and a call was sent to Banff for assistance.
>
> In 45 minutes Foreman McAuley had gathered a force of men, equipped them with fire fighting apparatus, served out rations and was on the way to the scene of the fire via a freight car.
>
> The firefighters returned Wednesday, having succeeded in subduing the flames after they had burned over some 25 to 30 acres of jack pine.
>
> Supt. Wardle is acquiring a reputation as a firefighter, spending his nights helping to subdue incipient fires in the park (*Crag and Canyon*, 28 June 1919).

> **Big Forest Fires on in Alberta**
>
> Calgary, Alta. – Bad forest fires are again raging forty to fifty

miles southeast of Calgary, in the Sheep Creek valley. A forest fire is also reported in the valuable timber in the Porcupine Hills (*Crag and Canyon*, 5 July 1919).

On account of the fires on the Morley reserve it has been found necessary to postpone Indian Day in Banff. Should much needed rains come and the fires be extinguished it is possible the annual event will be pulled off some time in August.

What threatened to be a serious fire broke out in the bush a couple of miles this side of Canmore Wednesday afternoon, but was subdued after burning over a few miles.

Fire broke out at the nuisance grounds, a periodical affair, Wednesday night and some difficulty was experienced in extinguishing the blaze and preventing it from spreading (*Crag and Canyon*, 19 July 1919).

The fire described at the "nuisance grounds" refers to the old dump at the base of Mt. Rundle, near the golf course. The fire that burned "over a few miles" near Canmore probably included an area near the east gate of today's Banff Park.

1920-29

Park records and fire scar/stand origin analyses reveal that several large fires burned in the 1920s in Banff Park. Perhaps the fire prevention and suppression emphasis in the Bow Valley was successful, for as Figure 17 shows, the majority of large fires were in backcountry areas away from the railroad. Approximately 8000 ha burned during the period, mainly in three large fires in the Red Deer, Spray, and Cascade valleys (Table 7).

Figure 18 indicates the close correlation between quarterly precipitation and fire activity with dry summers such as 1920, 1921, and 1929 having major fires. Although the summer of 1928 was wet, the dry fall season probably led to the Goat Range fire in late September.

A report by E.C. Carleton (1961) on the history of fires in Rocky Mountains (Banff) National Park provides much of the background information for the 1920s and 1930s.

Many of the fires reported by Carleton are quite small (less than 40 ha) and are not discussed in detail.

1920: The RCMP Are Called In

The dry year of 1919, and less than average precipitation in the summer of 1920 (Fig. 18) were bound to favour forest fires, and in August 1920 Rocky Mountains (Banff) Park had several significant blazes. The Park Superintendent noted the situation in his annual report.

> Owing to the extreme dryness of the weather during the summer and the frequent high winds considerable anxiety was felt with regard to forest fires. Thanks to the vigilance of the warden staff and the improvised equipment with which we are now furnished we were

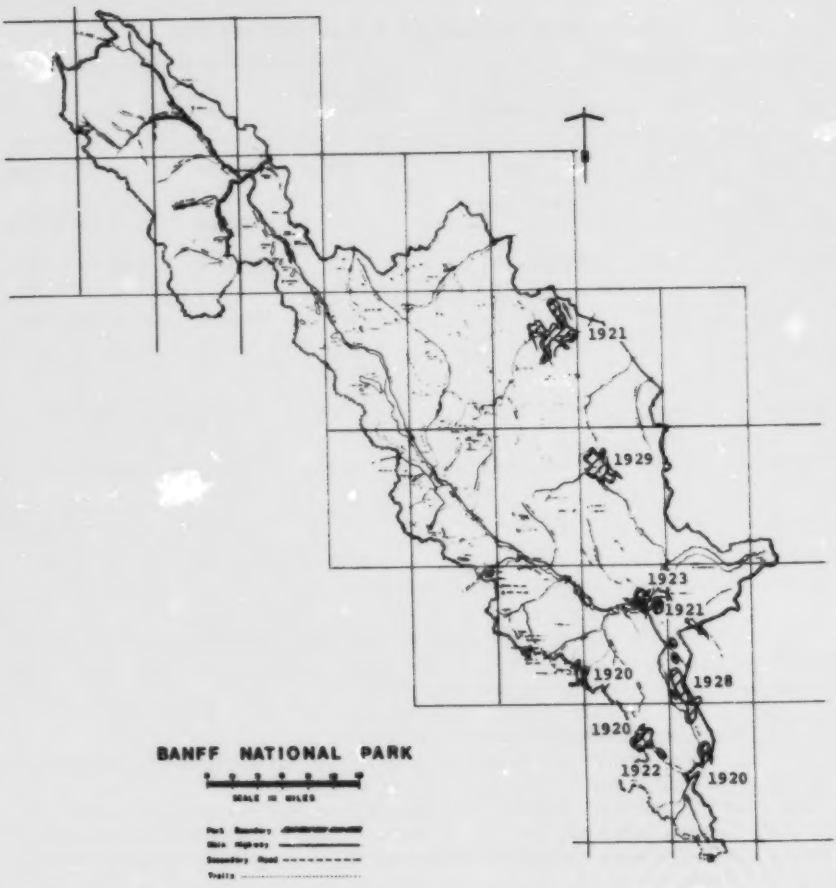


Fig. 17. Location of Banff National Park fires (1920–29).

able to extinguish every outbreak of fire without much difficulty. Two fires, however, entered the park from the British Columbia side of the divide, one at the head of Bryant Creek, and the other at the head of Douglas Creek. Another fire occurred at the Kananaskis lakes, the latter burning over about 2,000 acres of mixed growth. The Royal Canadian Mounted Police gave valuable assistance in fighting these more serious fires. The total expenditure for fire fighting for the year was $4,578.82 (Dept. of Interior Annual Report for 1920).

Table 7. Banff National Park fires >100 ha (1920-29)

Year	Date	Location	Area burned (ha)	Cause	Reference
1920	15 Aug.	Spray Lake	400	Unknown	*Crag and Canyon*
1920	15 Aug.	Howard Douglas Creek	300	Unknown	*Crag and Canyon* Dept. Int. Reports
1920	15 Aug.	Bryant Creek	600	Unknown	*Crag and Canyon*
1921	23 June	Mt. Rundle Dump	100	Settlement	*Crag and Canyon*
1921		Red Deer River	4300	Lightning	Stand analysis
1922	19 July - 8 Aug.	Bryant Creek	100?	Unknown	Carleton (1961)
1923	17 Apr.	Stoney Squaw	100	Woods operation	Carleton (1961)
1928	24 Sept.	Goat Range	1700	Recreation	Carleton (1961) *Crag and Canyon*
1929	12-19 Aug.	Cuthead	2900	Recreation	*Calgary Herald*

The smoke in the air that summer provoked the *Crag and Canyon* to remind the government that the fire guards constructed near Banff had not been maintained during previous years.

> **Fire Guards Needed**
> ... Over twelve years ago *Crag and Canyon* persistently advocated fire guards for the village, and at length some attention was given to this matter. But the fire guards have not been kept in repair and in many instances are at the present time covered with a growth of young timber and almost obliterated *(Crag and Canyon,* 22 August 1920).

The fires reported by the Superintendent on Bryant and Douglas creeks probably spotted over the Continental Divide from the Valley of the Rocks on the headwaters of the Simpson River. The Bryant Creek fire burned approximately 600 ha on the south side of Allenby Pass (Fig. 17) whereas the Douglas Creek fire was smaller, probably torching about 300 ha on south-facing slopes. Carleton (1961) also reports a 1920 fire that lasted 8 days in the upper Bow River. The exact location and size of this fire is not known.

1921: Probable Year of the Red Deer Fire

A large burn of over 4000 ha on the Red Deer River is not referred to in any records examined, but fire scars suggest a date of approximately

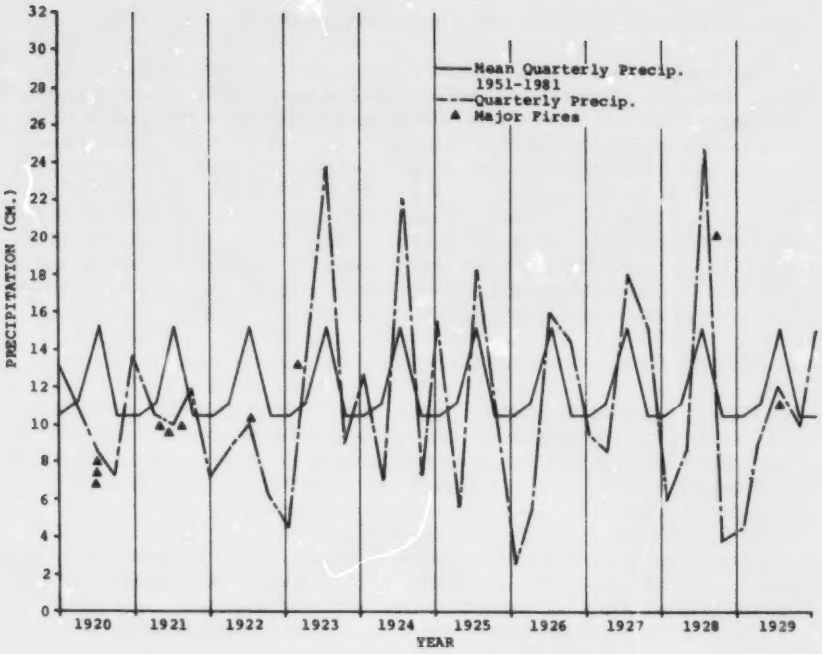


Fig. 18. Total quarterly precipitation for Banff weather station (1920-29).

1921. The fire ran from south to north, beginning near Snowflake Lake, descending into the valley near Scotch Camp, and burning through the lower reaches of Divide and Tyrell valleys (Fig. 17).

Elsewhere in the park, the Superintendent reported other fires.

> **Forest Fires** -- During the season there were 24 forest fires. Seven of these were started by sparks from passing engines. The only fire which could be considered of a serious nature occurred on June 23 on the northern slopes of Rundle Mountain, giving the warden staff considerable trouble and burning over approximately 150 acres of land before it could be got under control (Dept. of Interior Annual Report for 1921).

During the year, the Park Service continued improving fire pumps, as recorded by the Commissioner in the Dept. of Interior Annual Report for 1921.

1922-27: Bad Fires in the Other Mountain Parks

Although the area of today's BNP had no extensive fires from 1922 to 1927, Rocky Mountains National Park of that period (Fig. 5) and the other mountain parks had their share. These years saw the continued development of fire detection and fighting capability. In 1922 the Commissioner reported the instigation of aircraft fire patrols.

> In Waterton Lakes park the air patrols from High River made daily tours over the park and in Kootenay and Rocky Mountains parks an inspection and a selection were made for an aerodrome site and a number of landing places chosen for the proposed air patrols in these two parks (Dept. of Interior Annual Report for 1922).

Near Banff, water storage tanks were also constructed.

> In Rocky Mountains park a new device was introduced by installing two large wooden tanks on Sulphur mountain which will act as reservoirs for water during the dry seasons, collecting and storing a supply from small rills which would not otherwise provide enough for pumps (Dept. of Interior Annual Report for 1922).

Several more of these tanks were later constructed elsewhere in the park. In addition, great emphasis was placed on warden training as indicated in the Dept. of Interior Annual Report for 1924.

On 27 April 1923 approximately 100 ha burned near Wards Log Chute on Stoney Squaw north of Banff. According to Carleton (1961) "Wardens W. Peyto and J. Naylor and supervising Wardens Knight, Giddie and Langford cut off the fire from climbing the mountain after two negative attempts."

The year 1925 had a dry early summer (Fig. 18) and in the mountain national parks fires "were of greater extent than in any year since the park was established" (Dept. of Interior Annual Report for 1925). Approximately 20 000 hectares burned in Rocky Mountains, Yoho, Kootenay, Jasper, and Glacier parks, the majority of which went up in a massive conflagration in the Chaba-Athabasca River area of Jasper.

> The fire was very hard to fight owing to the tremendous amount of brule and the fact that at the point where the fire raged there was a wide valley with the fire coming in from four valleys to centre there (Dept. of Interior Annual Report for 1925).

In Rocky Mountains Park, 1925 was the year of a dangerous fire on the Panther River, just east of today's park boundaries. Wardens and Division of Forestry staff pooled their resources on this blaze (Dept. of Interior Annual Report for 1925; Carleton 1961).

The dry conditions continued into 1926, and this time it was Yoho and Kootenay's turn to burn.

> The year was one of the most serious from the point of forest fires experienced by parks' officers since the organization of this branch.

A hot, dry June made the forests as inflammable as a match box and the low humidity was followed by severe electrical storms with little rain. The result was the outbreak of a number of fires due to lightning. Yoho and Kootenay parks suffered most heavily. The most severe fire in Yoho park was one which started outside the boundary. Fanned by high winds, in two days it leaped over seven miles and entered the Kicking Horse valley, nearly entrapping twenty men who were on their way to meet it. After a long fight this fire was got under control with a loss of about 7,200 acres of timber. Several other outbreaks occurred in this park but were extinguished without serious loss. In Kootenay park ten fires occurred, nine of which were got under control without serious damage. The tenth, which broke out on July 6, was one of the fiercest that has ever occurred in the parks. It raged for about six weeks. During this period no rain fell and for the first three weeks high winds and low humidity provided the worst possible conditions. A force of 200 men with all available equipment, fought desperately to protect the scenic beauty of the Banff-Windermere highway. The engineering staffs, foremen, timekeepers, mechanics, cooks and labourers worked in many cases literally day and night. The acting superintendent of Kootenay park was in charge of the operations and for six weeks this officer was never in bed. A gang of thirty men, with several trucks and a quantity of hose, was loaned by the Canadian Pacific Railway. The Royal Canadian Mounted Police also lent their assistance in patrolling the road and convoying tourists. During its course the fire crossed the highway, necessitating the closing of the road to through motor traffic for a short time. In all about four miles were burned over but, through the efforts of the fire fighters, all bridges, wardens' cabins and other buildings in the area were saved. Although the loss was considerable, it is believed the scenery along the road will not be seriously impaired. On the contrary, once the new growth has restored the green, it is probable that the opening up of the forest, affording as it does wider and more distant vistas, will be an improvement from the scenic point of view. In this fire the portable units and other mechanical equipment developed by the National Parks Branch were of the greatest assistance. It must be admitted that without these aids the losses would have been much more severe. As it was, in the end the fire, instead of having to be guarded and left to burn itself out after being isolated, as is usually the case with such severe conflagrations, was put out, and secondary outbreaks prevented as well (Dept. of Interior Annual Report for 1926).

The fires of the year prompted a serious evaluation of firefighting capability.

On August 30 and 31 a convention of the parks' superintendents and supervising wardens was held at Banff with the Supervisor of Forest Protection from head office in the chair. A number of questions relating to fire protection methods were discussed and the interchange of views resulting from the difficult experiences of the year

proved mutually beneficial and led to a number of valuable suggestions. The Supervisor of Forest Protection later visited all the various parks and inspected the existing equipment.

As a result of investigations at head office a new portable motor pumping unit was developed which weighs only forty-five pounds. These pumps can be readily carried on pony back or by hand and will be specially useful at high elevations where a hard climb is necessary. The mechanical forest fire fighting equipment now in use in the different parks includes 79 portable pumping units, two auto pumpers, one trailer pumper, three railway motor speeders, eight hand speeders, three motor boats, 48 canvas relay tanks and 92 canvas water pack bags equipped with hand pumps (Dept. of Interior Annual Report for 1926).

In 1927 the BNP area had no significant fires, but the next 2 years were to keep the park's staff on the go.

1928: Goat Range Fire

The danger of a fire starting in the Spray Valley and burning north into the Banff townsite must have worried many park administrators over the years, especially after the 1908 fire. In fact, a fire guard was constructed 6 km south of Banff to meet this eventuality. The concern was wise for in September of 1928 a large fire spread northwards from Goat Pass and over the Goat Range towards Banff. Much of the fire was in extremely rugged terrain and crews had a difficult time fighting it. Figure 19, a clipping from the *Crag and Canyon*, tells the story.

1929: The Cuthead Fire

The winter, spring, and summer quarters of 1929 had below average precipitation (Fig. 18) and in the summer of 1929 there were several serious forest fires on the eastern slopes of the Rockies. The 24 July 1929 *Calgary Herald* headlined stories on fires in the Bow River Forest Reserve. In the Banff area, a minor fire burned approximately 5 ha near Johnston Canyon on 14 July (Carleton 1961). Then, on 12 August, a major fire was reported on Cuthead Creek in the Cascade Valley. The *Calgary Daily Herald* of 14 and 16 August observes that the fire was probably started by "careless campers" before 13 August, and burned southward. By 15 August it had a front of over 4 km and a depth varying from 1 to 5 km. The fire was "difficult to combat" due to "the steep side of a mountain with much deadfall in the underbrush." As Carleton (1961) summarizes, 75 firefighters worked on the fire at a cost of over $14 000 (an expensive fire at that time). Some 2900 ha were burned on both sides of Cuthead Creek (Fig. 17).

VOL. XXVIII, No. 22.

Forest Fire in Spray Valley Now Under Control

Park Officials Believe Little Likelihood of a Further Outbreak —Little Damage

For the past three weeks the Crag & Canyon has on Friday evenings reported the Spray River forest fire under control, and every Saturday morning the report has come in from the strickened area that the fire had run wild again. As a result, Friday evening has come to be called a "hoodoo" evening by the fighters. On that evening a wind has come up and scattered the fire with the result that Saturday morning would find a new menace and it would be necessary to [illegible] back fighters who had been let go the night previous.

However, there is little need of fearing tonight as a "hoodoo" evening, for with the fire reduced to several half acre spot fires and a snow blanket on the ground this morning, there is little chance of the fickle fire demon going on the rampage again.

Now that the fire is well under control, a few facts can be obtained of damage done and the extent of the fire. Early this week there were 31 Canmore men fighting localized fires on the Goat Creek side, and 18 men on the Spray river side. Wednesday most of the Canmore men returned to their home and only 27 men were at the scene.

The thirty-one men called out of Canmore on Saturday were used to fight small spot fires that were caused by a sudden windstorm carrying sparks and embers over to the Goat creek valley side, and dropping them amongst rotten logs and fallen timber. These spot fires were two miles of the way up the east side of Goat mountain, near the head waters of Goat Creek and did not reach the valley. At no time was Canmore threatened with the fire.

The fire started on the Spray Valley side of Goat mountain a short distance beyond Goat Pass. At this point are many open spots with long dried grass through which the fire traveled till it entered an old timber berth. The branches and small ends from the lumbering operations of 25 years ago, as well as the charred stumps of a previous fire were as touchwood for the hungry flames and made fire fighting very difficult. The fire was kept out of the green standing timber and confined to the less valuable area. On this side of the mountain are no running streams, therefore the fighters were hampered by lack of water, the Spray being too far away to be of much use. By Friday night, September 28th, the fire was burning itself out, having reached bare rock above the timber line, when a strong gale blew. This added to the wind created by the fire carried embers and sparks up the mountain on to the bare rocks. Unfortunately at one point is what is termed a split or double summit in the Goat range. Through this the terrific wind carried burning embers, dropping some just over the crest, amongst rotten logs and fallen timber and very close to the source of Goat creek. To combat these spot fires, the Canmore men were called out, it being much easier and quicker to take men in from that town than from Banff.

The area burned comprises about four square miles, and from a financial standpoint represents little loss as some 25 years ago this area was worked by the Ucluelet Lumber Co., and as yet there was no merchantable timber there. As the fire was confined to this field, no standing timber which could be merchantable was lost. Another thing which decreased the value of this area is the fact that in 1903 this section was completely burned over and the fire has largely consumed the partly charred trees left from that time.

From a scenic standpoint, this fire has been of no detriment to the park, as the Spray river valley is not a tourist route and it is only the odd fishing outfit which ever gets up as far as the fire zone. The Goat creek side of the fire cannot be seen very well by trail riders as it has been confined to the timber line on the top of Goat mountain and the area is too small to be discernible.

The firefighters are of the opinion that the fire was started by the carelessness of some fishing outfit up the Spray river, who were not careful to full extinguish their fire when they left.

Fig. 19. *Crag and Canyon* account of the 1928 Goat Range fire.

1930–39

Approximately 8000 ha burned from 1930 to 1939, over half of it in the 1936 Flints Park fire (Fig. 20, Table 8). The relationship between forest fires and quarterly precipitation is again well shown in Figure 21. Two of the worst fire years in the decade, 1934 and 1936, had well below average spring and summer quarter precipitation. The remaining years all appear relatively moist – despite the infamous drought conditions of the "Dirty Thirties" in the North American Midwest.

The depression years of the 1930s reduced the number of park visitors, causing some hardships for the park's tourist industry (Dept. of Interior Annual Reports). However, the number of staff and available men for

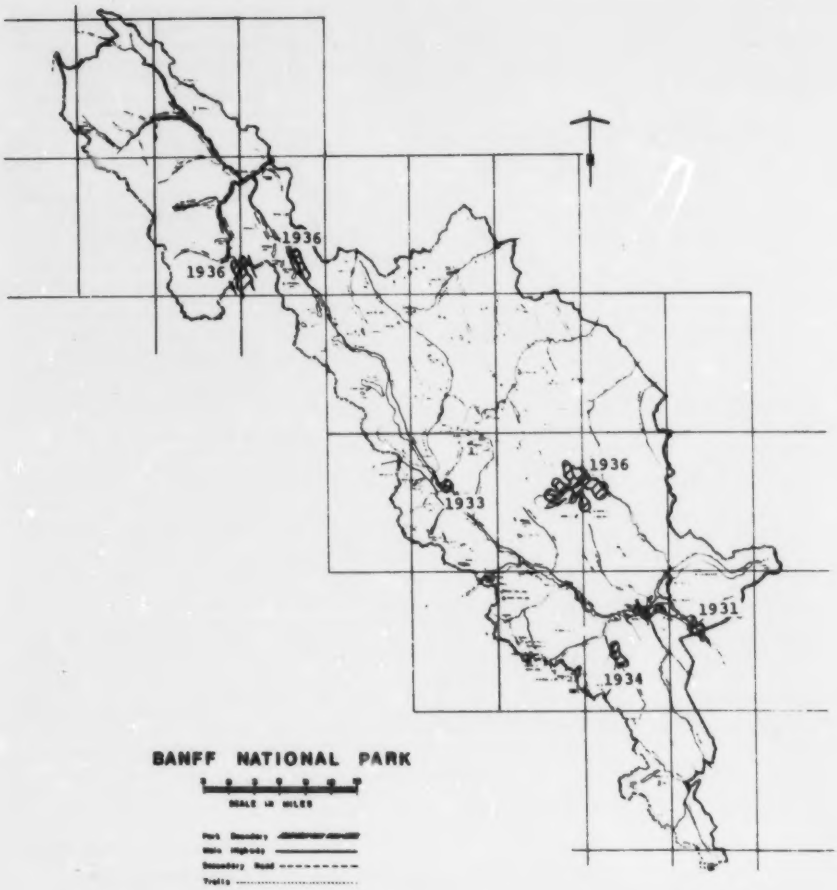


Fig. 20. Location of Banff National Park fires (1930-39).

activities such as firefighting increased thanks to government relief projects funded under the Public Works Construction Act of 1934. This act provided work for hundreds of men on projects such as the Banff-Jasper Highway and the Banff Administration Building (Dept. of Interior Annual Report for 1934).

1930-35: Quiet Except for the Brewster Creek Fire

The first years of the 1930s apparently were not bad fire years in

Table 8. Banff National Park fires (1930-39)

Year	Date	Location	Area burned (ha)	Cause	Reference
1931	4 Aug.	Carrot Creek	50	Railroad	Carleton (1961)
1933	16 Aug.	Kingfisher Lake	50	Recreation	Carleton (1961)
1934	20 Aug.	Brewster Creek	1000	Unknown	Carleton (1961) Dept. Int. Reports
1936	29 June	Silverhorn	1100	Lightning	*Crag and Canyon*
1936	6-13 Aug.	Flints Park (Cascade)	5200	Recreation	*Crag and Canyon* Carleton (1961)
1936	12 Aug.	Howse Pass	630	Unknown	*Crag and Canyon*

Banff Park. Carleton (1961) describes some minor fires, the worst of which appear to have been on Carrot Creek in 1931, near Kingfisher Lake in 1933, and on Brewster Creek in 1934. The Brewster Creek fire burned approximately 1000 ha on the southwest slopes of the Sundance Range.

In 1934 dry conditions encouraged several other large fires in the Canadian Rockies, including a large fire that burned in Sage Creek, B.C., and threatened Waterton Lakes National Park (Dept. of Interior Annual Report for 1934).

1936: Fires Everywhere

Few years compare with 1936 for fire activity in the Rockies in and around BNP. The Banff quarterly precipitation graph (Fig. 21) shows that the year had exceptionally low precipitation. This dryness led to fire outbreaks throughout the Rockies. In the Kananaskis Valley east of Banff, Alberta Forest Service Ranger P. Campbell described a blowup that occurred on 9 August.

> About 12 noon on the 9th, several spot fires were noticed on the north side of Galatea Creek near the mouth...but wind developed into a gale...by 1 p.m. fire was a raging inferno in the old burn on the north side of Kananaskis River north from the mouth of Galatea Creek. It climbed up the side of Mt. Bogart and where it reached the top, live embers were carried across Kananaskis Valley a distance of 3 1/2 miles starting a fire 2 miles south of Boundary Cabin...by 6 p.m. the Kananaskis Valley was all on fire for a distance of 6 miles along (long?) by three miles wide (Alberta Forest Service 1936a).

Just south of the fire in the Kananaskis, a massive conflagration blackened over 32 000 ha of the Elk Valley in British Columbia between

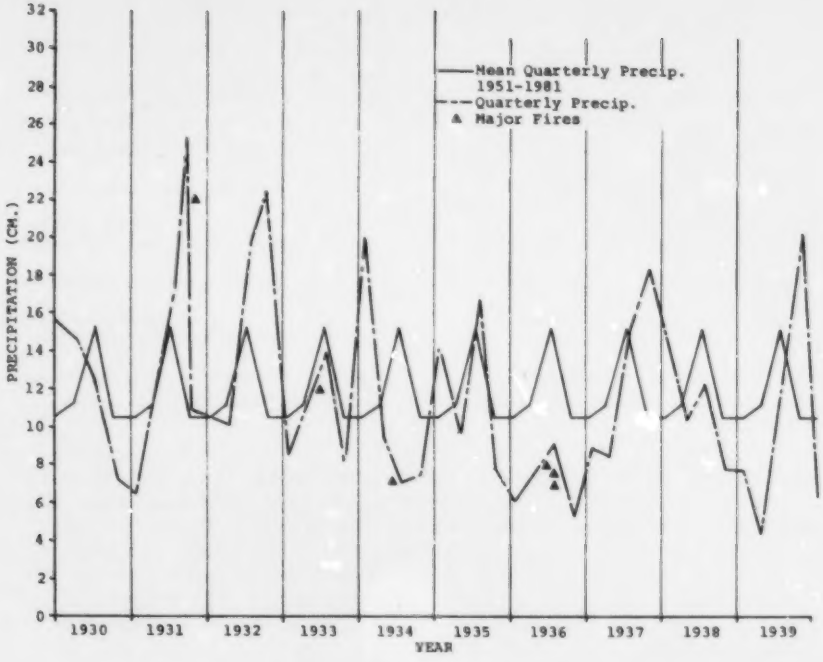


Fig. 21. Total quarterly precipitation for Banff weather station (1930-39).

14 June and 14 August (B.C. Forest Service 1936). On 23 July gale force winds lofted the fire across Weary Creek Gap into Alberta, where it burned a further 25 000 ha in the Highwood River drainage (Patterson 1961; Alberta Forest Service 1936b).

The fire season was no less spectacular in Banff Park. The Silverhorn Fire burned approximately 1100 ha in the northern part of the park near Bow Pass.

> 25 June — Silverhorn Fire. Lightning strike near Mistaya Lake — beyond Camp Fifteen on Mistaya River. Fire spread from Silverhorn Creek south for 2.5 miles along road right-of-way, crowned and went up Weed Mountain. 236 men and pumps under Warden J. Naylor, R. Cathcart and W. Neish, pumped water from the Mistaya River and used relays while the fire burned uphill. Timber between Silverhorn Creek and south for 3 miles was destroyed — mainly spruce and pine — 12 inch butt trees — some alpine fir and balsam (Carleton 1961).

In July 1936 a series of small fires continued to keep the Warden Service busy. Then 2 weeks of explosive fires occurred in the first half of August.

> 6 August – Cascade Fire. Fire reported by 3 hikers who had been into Lake Mystic over to Sawback and upon reaching the junction of Sawback Creek and Cascade River saw smoke up the valley near the base of Block Mountain. Fire was running down valley (Warden C. Fuller coming up from Stoney Creek was notified by the hikers). Fire continued to run down valley to Cuthead, fanned by strong winds to within a half mile of Cuthead junction.
>
> The fire also crossed the Cascade River before it was brought under control by the 13 August, 1936. Wardens Stenton and Gladstone came in to the fire via the Forth Mile Trail to Sawback Lake.
>
> 12 August – Howse River Fire. A fire was burning on the Blaeberry River on the British Columbia side – crossed the Howse Pass and encroached a half mile on the Banff Park side. Park Warden Jack Naylor planned to try and stop the fire at the mouth of Conway Creek. Both east and west sides of the valley were burning as far as Mount David. On the 13 August the fire advanced a half mile against the wind (Carleton 1961).

Two clippings from the *Crag and Canyon* (Fig. 22) also provide information on the Howse River and Cascade (Flints Park) fires, indicating that cooler weather and showers about 12 August reduced the fire hazard. The Flints Park (Cascade) fire probably originated from an outfitter's camp near the base of Badger Pass, and swept over 5200 ha burning the upper Cascade Valley nearly from side to side. Approximately 650 ha burned in Banff Park at Howse Pass, although a much larger area burned outside the park in the Blaeberry Valley of B.C.

1937-39: No Serious Fires

Moister conditions prevailed in the Banff area in the year 1937, and the records show no remarkable fires in the park. In 1938 a fire on the lower Siffleur River began backing into the park, but was met by a crew near the park boundary.

> 1 August – Siffleur River Forest Fire. A lightning strike fire burned over 6 acres in the ground and the surface moss – 20 large spruce burned. Area was the east half of Section 24, Township 33, Range 18, a half mile outside the Park boundary on the west side of the Siffleur River (Joe Squires helped fight this fire and old Jim Simpson packed into it) (Carleton 1961).

Other minor fires in 1938 occurred near Nigel Creek on the Banff Jasper highway construction project (Carleton 1961). A series of small fires in 1939 caused some concern, and Superintendent Jennings closed all park trails in latter August until a rain reduced the hazard.

Vol. XXXVI, No. 32.

Timber Fire Breaks Out in Cascade Valley

A timber fire was discovered in the upper reaches of the Cascade Valley on Thursday afternoon and a gang of some 40 men were assembled as quickly as possible and despatched to the scene of the outbreak, being transported by car as far as Stoney Creek, from which point they would have to walk up the valley, to the scene of the lower edge of the fire, which is some 3½ miles above the mouth of Cuthead creek.

From the meagre information which has filtered through it has been fairly definitely established that the fire had its origin at or near the foot of Badger Pass on the headwaters of Cascade river in Flint Park. The fire has already burned over part of the valley on Sawback creek, but there is no heavy stand of timber in this particular district. It is believed to be working up the north fork of Cascade river, and in this district there are heavy stands of timber. The fire has worked down Cascade river to a point about 3½ miles above Cuthead cabin, and at this point the men are fighting the outbreak. Supplies and equipment are being rushed in as fast as possible, and if necessary another gang will be sent to the scene tomorrow morning.

A gang of men has been sent into the territory of Howse Pass, in the north end of the Park, where a fire is working up the Blaeberry River in British Columbia. This fire is at present working its way slowly against the wind, but it was deemed advisable to send a gang to this point to prevent the blaze from extending into the park.

Cascade Valley Fire is Reported to be Under Control

Shortly before noon on Thursday an electric storm passed over Mount Rundle, and one of the lightning bolts struck the side of the mountain starting a fire, but fortunately this fire was in sparsely scattered trees. A small gang of men was rushed to the scene and within a few hours the fire was put out. However, the sight of smoke rising up on the mountain side caused many anxious moments for residents and visitors.

Reports this morning from the fire up the Cascade Valley is to the effect that the gang of men working there have the outbreak under complete control. The cooler weather of the past couple of days, with one or two light showers of rain have greatly assisted the men. In the early part of the week Stan Peyto drove a caterpillar tractor from the end of the road near Stony Creek to within a short distance of the fire near the Cuthead cabin and then returned and hooked onto a trailer on which is mounted a big pump and safely negotiated the improvised road. This pump was of a great deal of assistance in bringing the fire under control as it throws a heavy stream of water, enough to keep two smaller units working to capacity on the mountain side. Charlie Campbell, truck driver, also took his machine to within a short distance of the fire, carrying supplies to the men who are at work. Charlie McAulay picked out the trail.

There is little information about the fire which is burning in the Howse Pass country in the northwest corner of the park. Jack Naylor is in charge of the gang of men who are fighting the outbreak which came into the park from the head of the Blaeberry River in British Columbia. Jack sent a man to the telephone line yesterday and requested the local office to supply him with two more pumps and a considerable amount of hose, which is being rushed forward. The fire is stated to have burned for about a mile into the park and was on both sides of the valley, but it was thought with extra equipment it could be brought under control.

Fig. 22. *Crag and Canyon* accounts of the 1936 fires.

1940–80

The early decades of the 40 years since 1940 saw a very strong emphasis by the park on fire prevention, detection, and suppression. But as the years passed the priority placed on these activities fell sharply. A low occurrence of fires obviously reduced interest in fire control, for as Figure 23 shows, only four major fires (over 40 ha) occurred and the Saskatchewan Crossing Fire of 1940 burned most of the area (Table 9). Even the number of smaller fires recorded from 1940 to 1981 (Table 10) was not a serious problem.

One probable reason for the low fire activity was the high number of wet fire seasons. As Figures 24–27 show, well over half the spring and summer seasons had above average precipitation. As with other decades, a relationship between fire occurrence and dry years is obvious.

The period since 1940 is significant for the fantastic increase in visitors to Banff Park. From the 1930s when annual park visitors numbered less than 200 000, use increased such that by the late 1970s several million people passed through Banff's east gate annually. This stream of visitors to the park's highways and trails caused many problems in resource management, law enforcement, public relations, and rescue, which further diverted the Warden Service's attention from its traditional role of fire control.

1940: Banff's Last Big Fire Year

The extremely dry winter, spring, and summer of 1940 (Fig. 24) were bound to bring on an early fire season, and the start of what was to be a spectacular fire occurred near Glacier Lake on 3 July.

> **Fire Raging Over Banff National Park**
> Fire filled the vast North Saskatchewan River Valley along the Banff-Jasper Highway 55 miles north of Lake Louise on Thursday evening, but a weary crew of 150 men brought the raging forest fire under control about midnight according to reports.
>
> The fire jumped the river in the afternoon of Thursday after sweeping around ruining the forest on the sides of Mount Wilson. Thirty men trapped in cross fires were rescued with difficulty by the main body of their comrades, but they lost all their equipment.
>
> Welcome rain relieved 100 weary men battling a big blaze in the Bow River Forest reserve 36 miles west of Turner Valley Thursday night, while a blaze 40 miles south of Rocky Mountain House was under control and the patrol of firemen there was reduced.
>
> Augmenting tired fire-fighters who had been working in shifts for 40 hours, P.J. Jennings sent additional crews of men to the Jasper highway fire Thursday while a crew came down from Jasper to bring the total of firemen to 150.
>
> The blaze broke out near Glacier Lake Wednesday morning and traveled with amazing speed down the Howse River to the North Saskatchewan jumping the new highway at Mile 52 Wednesday afternoon.

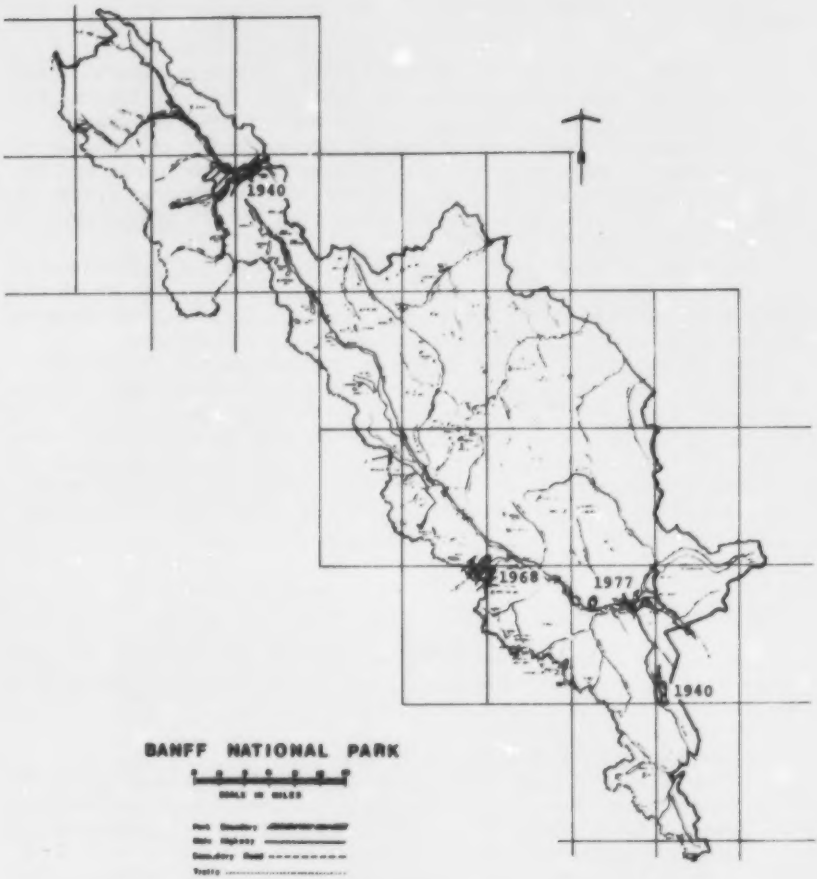


Fig. 23. Location of Banff National Park fires (1940-80).

Driven by a high wind, the blaze roared over the slopes of Mount Wilson and followed the new road for eight miles. Thursday it jumped the wide North Saskatchewan River and began encroaching on the sides of Mount Amery.

Because of small fires started by embers carried ahead of the big fire by the wind, the men were in tight spots many times. The worst enemy of the fire fighters was the wind, because it is impossible to back-fire if there is a wind.

The men rescued were trapped in a wooded valley by two spot fires springing up behind them. A party of about 50 other fighters

Table 9. Banff National Park fires>40 ha (1940-82)

Year	Date	Location	Area burned (ha)	Cause	Reference
1940	3-7 July	Saskatchewan Crossing	4000	Unknown	*Crag and Canyon*
1940	9-13 Aug.	Goat Range	200	Lightning?	*Crag and Canyon*
1968	9-15 July	Vermilion Pass	(in BNP) 300	Lightning	Park Records
1977	25 Apr.	Mt. Cory	45	Railroad	Park Records

fought their way through flying embers and thick smoke to reach the gang and bring them through a narrow bottle-neck between the blazes to safety.

All equipment was lost but Mr. Jennings believed some of the pumps could be salvaged, as they were thrown in creeks by the men. Hoses, blankets and tents were destroyed. Many lost personal possessions (*Crag and Canyon*, 5 July 1940).

In all, some 4000 ha were run over by the fire which narrowly missed the sites of today's warden station and visitor service centre. Much of the area affected had been burned only 30 years before.

In August 1940, the third fire since 1900 flared up on the slopes of Goat Mountain in the Spray Valley. Despite the danger to the town, the *Crag and Canyon* was more interested in criticizing the park service than discussing the fire.

Investigation Needed

Lightning, it is believed, on Friday, August 9th started a forest fire on the slope of Goat Mountain and thereby created a job termed in government phraseology "an emergency."

Through Saturday, Sunday and Monday, the blaze raged merrily while firefighters worked anything from ten to eighteen hours a day, snatched meals when they could, slept with clothes on wherever they could flop, and in addition to accepting the discomforts of the fire fighter's lot, took also its risks.

On Tuesday however the fire-fighters discovered that since Sunday, although discomforts, risks, working hours and kind of work had not changed they had been working on a "projet" (sic). Seemingly overnight (Saturday night) it had changed. A government official had stated so, therefore it was so.

Now, a rose by any other name may still be as sweet, but an "emergency" called a "project" certainly is not.

In the first place an "emergency" calls for 45 cents an hour with numbers of hours to be worked being the number required, be that number 8, 24 or any number in between. A "project" calls for an eight hour day with time and a half for overtime. This latter by the

Table 10. Banff National Park fires from 0.1 to 40 ha (1940-81)

Year	Date	Location	Area burned (ha)	Cause	Reference
1941	April	Minnewanka	10	Slash burned	Supt. Report
1942	April	Montane area near Banff	0.2	Railroad?	Supt. Report
1944	April	Mt. Rundle Dump	1	Man	Supt. Report
1944	Oct.	Railroad near Banff	1	Railroad	Supt. Report
1945	May	East Gate	0.5	Unknown	Supt. Report
1949	May	Unknown	2	Unknown	Supt. Report
1949	21 Oct.	Railroad near Banff	2	Railroad	Supt. Report
1949	21 Oct.	Railroad near Banff	3	Railroad	Supt. Report
1951-55	Missing data				
1956	June	Trans Canada Highway slash near Banff	2	Man	Supt. Report
1957	May	CPR 10 miles west	1	Man	Supt. Report
1957	May	TCH slashing	1		Supt. Report
1957	May	B/J Highway slashing	1		Supt. Report
1957	June	B/J Highway slashing	0.5	Man	Supt. Report
1957	June	B/J Highway slashing	0.5		Supt. Report
1958	Oct.	Norquay ski-jump construction	0.2		Supt. Report
1961	April	Highway slashing	1	Man	Supt. Report
1961	May	Hillsdale Meadows	1.5	Man	Supt. Report
1963	No data				
1964	April	Banff Railroad Station	1	Kids	Supt. Report
1964	July-August	CPR Right-of-way	1	Railroad	Supt. Report
	July-August	CPR Right-of-way	1	Railroad	CPW Report
1967	May	CPR	0.2	Lightning	CPW Report
1967	May	CPR	0.2	Unknown	CPW Report
1967	May	Highway traffic accident	0.2		CPW Report
1967	June	CPR near Banff	0.1	Railroad	CPW Report
1967	June	CPR near Banff	0.25		CPW Report
1967	June	CPR near Banff	2		CPW Report
1967	August	Hector Lake	7	Lightning	CPW Report
1967	August	Forty Mile Creek	1		CPW Report
1968		No fires greater than 0.1 ha besides Vermilion Fire			CPW Report
1969		No fires >0.1 ha			Supt. Report
1970	14 May	Banff Airport	0.5	Man	Fire Report
1970	26 Aug.	Mt. Cascade	0.25	Man	Fire Report
1970	17 Sept.	CPR Right-of-way	0.8	Railway	Fire Report
1971	18 May	CPR Right-of-way near Mt. Edith	0.2	Railway	Fire Report
1971	8 Aug.	Panther River	3	Lightning	Fire Report
1971	8 Aug.	Tunnel Mtn. Campground	0.5	Campfire	Fire Report
1972	19 Apr.	CPR — Vermilion Lakes	1	Railway	Fire Report
1973	No data				
1974	15 June	CPR near Banff	6	Railway	Fire Report
1975	No data				
1976	18 July	Near Bow River	0.5	Campfire	Fire Report
1977	7 July	Healy Creek overflow	0.5		Fire Report
1977	8 July	Minnewanka	0.2		Fire Report
1978	7 Oct.	Mt. Cory - Hwy. 1A slash	1.5	Man	Fire Report
1979	26 May	Calgary power line	0.2	Man	Fire Report
1979	5 July	CPR Right-of-way	0.2	Railway	Fire Report
1979	18 July	Mt. Peechee	0.2	Lightning	Fire Report
1979	August	Norquay Overpass	1	Campfire	Fire Report
1980	17 April	CPR — Duthill	0.5	Railroad	Fire Report
1980	22 July	Baker Creek	0.1	Lightning	Fire Report
1980	23 July	Mt. Wilson	0.1	Lightning	Fire Report
1980	28 July	Baker Creek	0.1	Lightning	Fire Report
1980	19 Aug.	Pilot Pond	1	Man	Fire Report
1980	19 Oct.	CPR Anthracite	0.2	Railroad	Fire Report
1981	No fires >0.1 ha				

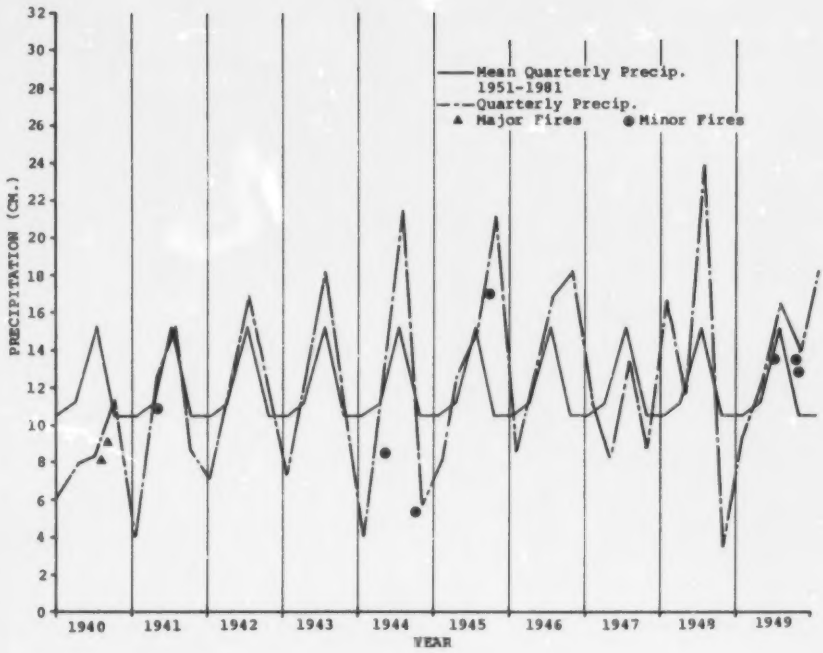


Fig. 24. Total quarterly precipitation for Banff weather station (1940-49).

Park Bureau's own Order-in-Council. The recent Jasper Highway fire was an emergency and fighters were paid the 45 cents an hour straight for all hours worked.

Somehow, it would seem, the brain which conceived the change of name for the work, overlooked a few possible results. The orders as transitted (sic) by radio-phone to Warden Bert Johnson, were that the work was and had been a "project" since the previous Sunday morning, the workers were to be paid a straight $3.60 per day as for an eight hour day on a "project," men would be required to work as many hours per day as necessary without overtime pay; pay for meals would be deducted from remuneration, and no reimbursement would be paid for clothes if ruined in the work.

The lame excuse given for this outstanding bit of smart work was that firefighters in the province of Alberta are paid 15 cents per hour, but the excuser overlooked the fact that provincial forest fire fighters also get free meals and reimbursement for clothes damaged or destroyed.

Changing the name of the work however had one unlooked for

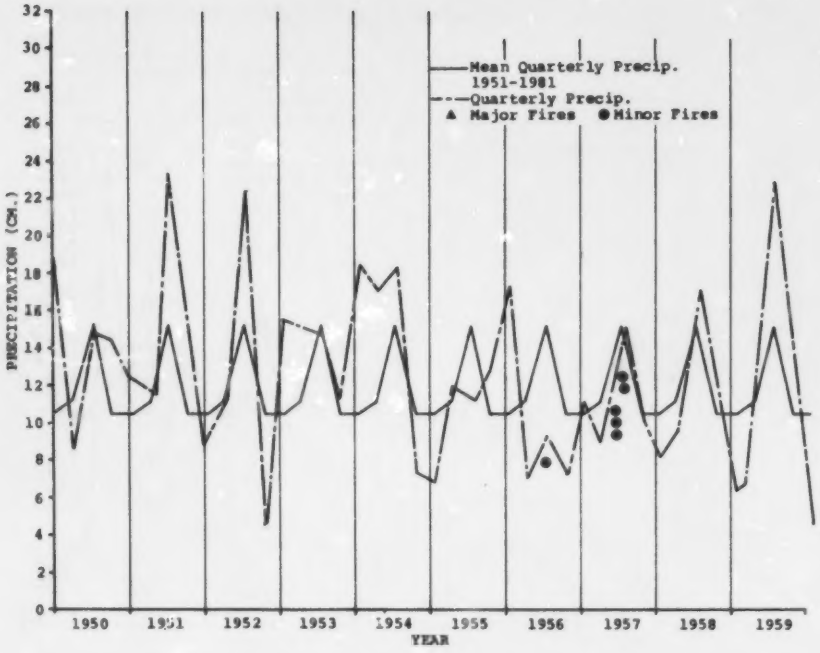


Fig. 25. Total quarterly precipitation for Banff weather station (1950-59).

result; it released the workers from legal obligation to fight the fire. Any man who quits an "emergency" without permission can be prosecuted; a man can quit a "project" without risking jail. And so directly the radioed news was received at the fire two Banff and ten Canmore men quit and returned home. More Canmore men quit the next day.

While figuring they could do as they pleased about classifying the firefighting job and changing the wages, the local authorities (or authority) evidently believed workers have not a similar freedom. After working a few hours on their Banff jobs, the two Banff men were fired for leaving the forest-fire without permission.

And that, as written here, is the information on the subject as given this paper by one of the firefighters.

Undoubtedly the Howse River fire in July cost the Parks Bureau a large sum of oney (sic), and possibly funds were not in sight with which to pay the costs of fighting the Goat Mountain blaze, but that does not justify the actions of the Parks Bureau.

Fighting a forest fire is a "work of emergency" and all the slick name-changing in the world cannot make it actually a "project." Calling it a "project" will not make it one and in this instance only

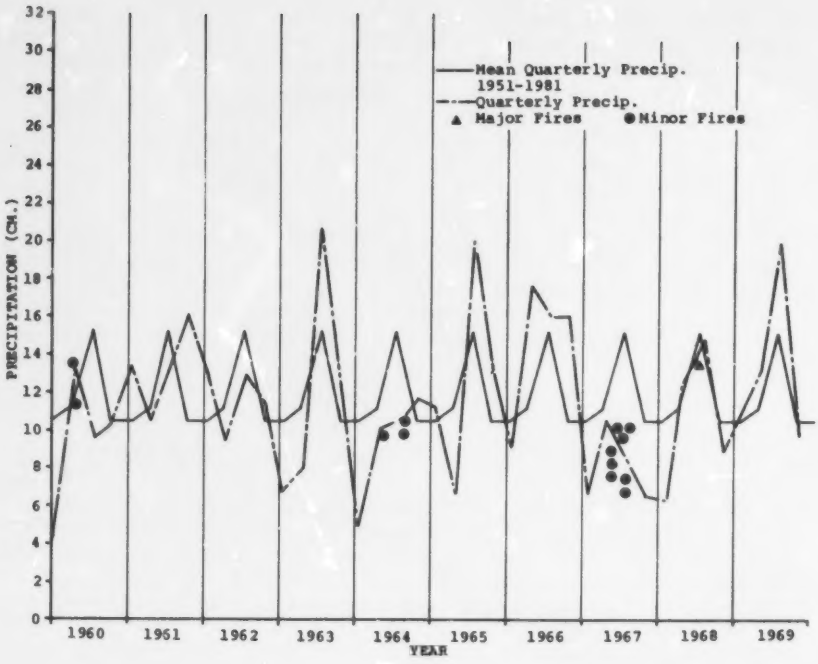


Fig. 26. Total quarterly precipitation for Banff weather station (1960-69).

supplied the flimsiest of camouflages for an action which looks like cheating the workers out of part of their honestly earned wages.

The Parks Bureau may call it business economy; others will give it various uncomplimentary names, and it not will be (sic) surprising if quite a few call it out-and-out robbery. At any rate the matter should be thoroughly looked into by competent and unbiased investigators (*Crag and Canyon*, 23 August 1940).

1941-49: Lookouts and Fire Roads

Although the Second World War ended the labour provided to Banff by the relief projects of the depression, a new source of labour was furnished through Alternative Service Work camps for conscientious objectors. Over 100 men were employed on these crews constructing fire roads and lookouts, and cutting timber for fire breaks and pine beetle control.

A fire detection lookout system (greatly expanded from the 1915

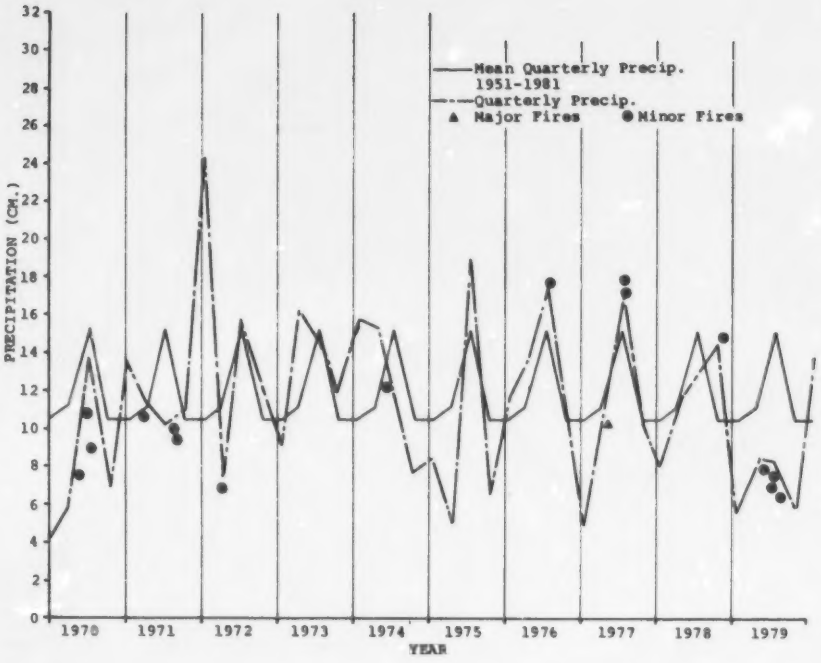


Fig. 27. Total quarterly precipitation for Banff weather station (1970-79).

effort) was begun in 1941. Superintendent Jennings reported that:

> The Beehive Lookout Cabin at Lake Louise was 90% complete at the end of the month. The prefabricated cabins for Jasper and Tunnel Mountain at Banff were completed during the month. The steel tower for Tunnel Mountain Lookout was received and erected and the floor placed on top (Supt. Rep. September 1941).

In July 1943 the park had lookouts on Tunnel, Castle, and Beehive in operation. The "construction of the lookout and living quarters at Sarbach was begun, and a lookout located at Sunset Point" (Supt. Rep. July 1943). The system was further developed when Aylmer and Bow Pass lookouts were built in 1946 and 1950, respectively.

For January 1942 Superintendent Jennings observed that the Alternative Service Work Camps had more than 100 men doing sanitation cutting in the Bow Valley mountain pine beetle outbreak (Supt. Rep. January 1942). In subsequent years Wardens instructed these crews in fire pump operation and directed the construction of fire roads and fire guards. By

October 1944, "the Cuthead fire trail was extended to within 5 miles of Windy" (Supt. Rep. October 1944), and in January 1945 "Alternative Service Work Camp No. 3 on the Spray River was employed in extending the fire guard on Rundle Mtn." (Supt. Rep. January 1945).

Beginning in 1940 the Canadian Forestry Service instigated Wardens (and Warden's wives) to collect fire weather information at various stations. By 1949 the following stations kept fire weather records and danger charts: Banff Headquarters, Lake Louise, Saskatchewan River Crossing, Yaha Tinda Ranch, and several lookouts (Miles and Bland 1974).

Despite all the effort in preparing for fires most years from 1941 to 1949 had exceptionally wet fire seasons (Fig. 24) with little possibility of serious fires. The dry winter and spring of 1949 caused some concern, and in May the Superintendent reported that: "due to the high fire hazard, special fire patrolmen were taken on in various districts" (Supt. Rep. May 1949).

1950-59: Fire Planning and Highway Construction

The 1950s were insignificant in Banff Park for forest fires, but still there was a serious interest in developing written plans and interagency firefighting agreements. In December of 1950 Chief Warden Bryant "attended meetings in Calgary and Field in the interests of coordinated fire fighting and mutual assistance planning" (Supt. Rep. December 1950). For July 1953 Superintendent B.I.M. Strong records that "the forest engineer for Banff Park was employed in preparing a fire control plan for the Park" (Supt. Rep. July 1953).

Steve Kun began his appointment as the Forestry Officer for western national parks in 1958 with duties in fire control, logging, nurseries, and fire detection. In 1959 Kun recorded that "on April 1 a meeting was held with the Eastern Rockies Forest Conservation Board officials to establish desirable cooperative fire control policies" (Supt. Rep. April 1959). This agreement was a prototype for the cooperative firefighting agreements that Parks Canada holds with Alberta and British Columbia.

The Trans Canada Highway construction project through Banff Park began at the East Gate on 23 July 1952 (Supt. Rep. July 1952). Fires escaping from burning debris piles along the slash caused minor fire problems in 1956 and 1957 (Table 10). The dry summer of 1956 (Fig. 25) led Superintendent Strong to write:

> Some extreme hazard was experienced during the month, in particular at Banff at Saskatchewan Crossing. Due to the hazard during the first week of June all park trails were closed to travel (Supt. Rep. June 1956).

During the same summer Yoho had a serious fire in the Otterhead Valley (Yoho National Park Warden Service 1974).

Throughout the 1950s Banff's Warden Service thinned forests each winter at locations such as Redearth Creek, and near Banff and Lake Louise. The timber was milled and used in park construction projects

(Supt. Rep. 1952-67). In addition, park staff thinned along the new Trans Canada Highway for aesthetic and fire hazard reasons.

1960-67: More Quiet Fire Years in Banff

Banff Park had no significant fires from 1960 to 1967. In nearby parks Yoho had a major fire in the Amiskwi in 1960 (Yoho National Park Warden Service 1974) and the Chaba River Valley in Jasper burned in 1961 (Warden G. Anderson pers. comm.). The summer of 1967 was very dry (Fig. 26) and Banff had several minor fires (Table 10). Elsewhere in the Rocky Mountains severe fires raged with the drought conditions. Probably the most spectacular of these was the Sundance Fire in northern Idaho, which on 1 September 1967 ran over 20 km in 9 hours (Anderson 1968). As Banff's dry conditions continued through the fall of 1967 and into the spring of 1968 (Fig. 26), the prospects were good for big fires in 1968.

1968: The Vermilion Pass Fire

At approximately 4:30 p.m. on 9 July lightning struck Mt. Whymper, 1.5 km northeast of Marble Canyon Warden Station. The fire quickly took hold in the heavy timber and deep duff, and by the evening of 11 July over 1500 ha were burned in Kootenay Park and an additional 500 ha across Vermilion Pass in Banff. Table 11 summarizes events of the blaze as derived from the Kootenay-Banff Fire Board of Review (Rogers 1969). It was driven by a west wind, crossing over the pass in a blowup on 10 July, and nearly burning Storm Mountain Lodge when it swept up the south-facing hillside east of the pass on 11 July.

The burn was the first major fire in over 60 years to threaten Banff Park's facilities seriously and the park's biggest fire since 1940. Thus it is not surprising that when the Alberta Forest Service Fire Control Officer was called in, he reported that "upon my arrival at the fire at 16:30 hours on July 11, organized confusion seemed to be the order of the day" (Rogers 1969). The Board of Review (Rogers 1969) described the many problems encountered with the suppression effort; these related mainly to the lack of experience and training in organizing to fight a large fire.

1969-80: Reorganization and Low Firefighting Emphasis

For nearly 60 years, the Banff Warden Service carried out its duties through a series of districts, each managed by a district Warden with assistants as required. Warden diaries prior to 1969 break duties down into the categories of patrols, phone line maintenance, trail maintenance, radio operation, maintenance of fire equipment, game observations, sealing of firearms, and miscellaneous duties (Chief Park Warden Reports 1968).

By 1968 the district system required changes. Increasing appreciation for the value of natural resources demanded a more coordinated and technical approach to resource management (Sime 1969). In addition,

Table 11. Summary of events: 1968 Vermilion Pass fire

Date	Time	Events (from Rogers 1969)
9 July 1968	16:30	Lightning but no rain observed in Marble Canyon area, Kootenay National Park
	16:40	Fire first observed by John Royko, Marble Canyon staff
	18:00	Initial attack began by Warden Hanley plus 4 men; fire crowning and advancing rapidly in N.E. direction
	19:00	Warden Winkler arrives at fire with 12 men, fire size approximately 8 ha and expanding quickly; flank and rear attack made
	21:30	Fire size 200 ha, crews of 68 men and 3 cats from Banff and Kootenay Building line on S.E. flank of fire; work continued all night
10 July	06:00	Fire not contained, still at approximately 200 ha after slowing down during night; fire intensity began to increase
	09:30	Warden Corrigal begins deploying cats on fireline at Banff Kootenay boundary; conscripted men from Banff put on S.E. flank line; fire advancing eastward
	12:30	Fire blows up, park boundary fire line abandoned, much smoke
	14:20	Fire spots onto south side of highway, and a running crown fire advanced east; helicopter rescue of hikers trapped near Stanley Glacier in progress
	17:00	Cessna Bird Dog plan and 3 Thrush Commander Water bombers provided by Alberta Forest Service land on Trans Canada Highway strip; crews trying to halt fire advance at selected areas of perimeter
	22:00	64 men shift holding flanks of fire near Marble Canyon; major Banff effort began to hold front of fire on Mt. Whymper north of highway
	24:00	Alberta Forest Service crews arrive and encamped at Castle Mtn. Forestry camp
11 July	05:00	Waterbombers begin striking S.W. flank
	10:00	Fire activity picking up on E. front south of highway
	12:00	Fire blew up south of highway and advanced eastward on north slopes of Storm Mtn. above Altrude Lakes
	13:00	Major fire run up south-facing slopes towards Storm Mtn. Lodge, and jumped highway from south to north; AFS crews on Storm Mtn. retreat to road; Storm Mtn. lodge evacuated and waterbomber and crew efforts made to save lodge; five AFS crews on fire and several cats begin pushing lines around N.E. and S.E. fire fronts; fire intensities decreasing
12 July	08:00	Rain began which continued intermittently all day (3.6 mm at Banff) with cloudy and cool conditions; fire advance had ceased and more cats and army crews were put on to consolidate lines around fire
	19:00	Reorganization of fire crews to coordinate action between Banff and Kootenay forces
13-15 July		Cool, rainy weather continued; fire lines were consolidated, mop-up and demanning begun

some duties such as mountain rescue required pooled manpower, which continually disrupted district operation. In 1968 the national park management improvement team recommended the following (Sime 1969):

1. transfer of maintenance duty to the maintenance and works subactivities;

2. centralization of Wardens for greater efficiency and working conditions.

Thus, in June 1969 the district system was reorganized in Banff Park, with new responsibilities being categorized as natural resource management, public safety, and enforcement of natural resource related regulations. By 1971 district fire equipment was removed from the 13 old districts and pooled at Lake Louise and Banff, with three park Wardens assigned to fire protection duties.

As a result of the Vermilion Fire, a 25-man native trail crew was hired and stationed at Castle Junction under Warden supervision. In 1971 Chief Park Warden Thorardson reported "The native trail crew were utilized on four small fires in Banff Park. As the crews were all certified fire fighters, no training was required" (BNP files).

However, the lack of fires in the early 1970s did not encourage Banff's managers to continue a high level of readiness for forest fires. The native trail crew was assigned to more trail construction duties with little or no training provided. The fire lookout system was found unnecessary and all lookouts were unmanned or torn down by 1978. The level of readiness in the Banff Warden Service in the latter years of the 1970s is reflected in the amount of fire-related training in 1976 and 1977. Out of over 600 man days of training, only 9 were devoted to fire control (Supt. Rep. 1976 and 1977).

Despite the lack of Warden fire control preparation, the basing of a helicopter in the park with a monsoon bucket and the excellent assistance of the Lake Louise and Banff townsite fire brigades helped keep fires to a minimum. The only major fire (45 ha) since 1970 occurred on 25 April 1977 when a fire ran up Mt. Cory from the CP Rail right-of-way.

Other Fires

Bryne (1964), citing from the research of Mair (1952), reports that in 1903 "fire destroyed the forest on the north side of the Bowe from the East gate to Anthracite. And in 1904 a fire burnt the forest in the Bow Valley north of the river from Vermilion Lakes west to Baker Creek."

No additional evidence found to date collaborates the occurrence of these fires. Mair (1952) also reports that in 1912 a fire "swept up both sides of the Spray Valley from Banff to Mile 18." This fire was probably the 1908 burn which did not approach within 6 miles of Banff.

In contrast with the above-reported fires which maybe did not occur, many locations in the lower Bow Valley show fire scars for years for which no reports of fire exist. In most cases these fires were of low intensity and limited extent, and thus may not have stimulated the park administration's concern.

SUMMARY STATISTICS AND ANALYSIS

Fire Location and Size

Table 12 summarizes the location and size of historical fires (over 40 ha), breaking them down as montane or subalpine depending on the main ecoregion burned. Some 36 fires burned predominantly in the 180 276 ha of lower subalpine ecoregion in Banff for a ratio of 0.200 fires per 1000 ha since 1880. In the 16 700 ha of montane ecoregion 17 major fires burned for a ratio of 1.02 fires per 1000 ha. The high frequency of fire burning in

Table 12. Summary of fires(>40 ha) for Banff National Park (1880-1980)

Year	Subalpine fires	Area (ha)
1881	Upper Bow	7 000
1885	Mid Bow	8 400
1889	Bow-Cascade	12 150
1889	Bryant	1 400
1891	North Saskatchewan	2 500
1894	Paradise Valley	150
1894	Upper Spray	2 900
1896	Bath Creek	1 050
1896	Lake Louise	150
1896	Mistaya	950
1896	Molar Creek	1 200
1902	Glacier Lake	450
1904	Moraine Lake	500
1904	Lake Louise	200
1904	Alexandra River	1 500
1906	Eldon	1 500
1908	Spray River	3 100
1908	Castle Junction	5 000
1909	Siffleur	1 750
1912	Chateau Lake Louise	100
1914	Minnewanka	100
1914	Forty Mile	300
1920	Spray Lake	400
1920	Howard Douglas	300
1920	Bryant Creek	600
1921	Red Deer River	4 300
1922	Bryant Creek	100
1928	Goat Range	1 700
1929	Cuthead	2 900
1933	King Fisher Lake	50
1934	Brewster Creek	1 000
1936	Silverhorn	1 100
1936	Flints Park	5 200
1936	Howse Pass	650
1940	Goat Range	200
1968	Vermilion Pass	500
TOTAL AREA		71 350
Mean fire size (excluding fires previous to 1889)		1 646

Year	Montane fires	Area (ha)
1881	Lower Bow	8 000
1889	Vermilion Lakes	100
1891	Lower Bow	7 400
1896	Saskatchewan Crossing	1 300
1897	Anthracite	1 000
1900	East Gate	250
1903	Mt. Edith	1 000
1905	Bankhead	700
1906	Anthracite	900
1910	Saskatchewan Crossing	2 500
1919	Mt. Rundle	100
1919	East Gate	200
1921	Mt. Rundle	100
1923	Stoney Squaw	100
1931	Carrot Creek	50
1940	Saskatchewan Crossing	4 000
1977	Mt. Cory	45
TOTAL AREA		27 745
Mean fire size (excluding fires previous to 1889)		1 234

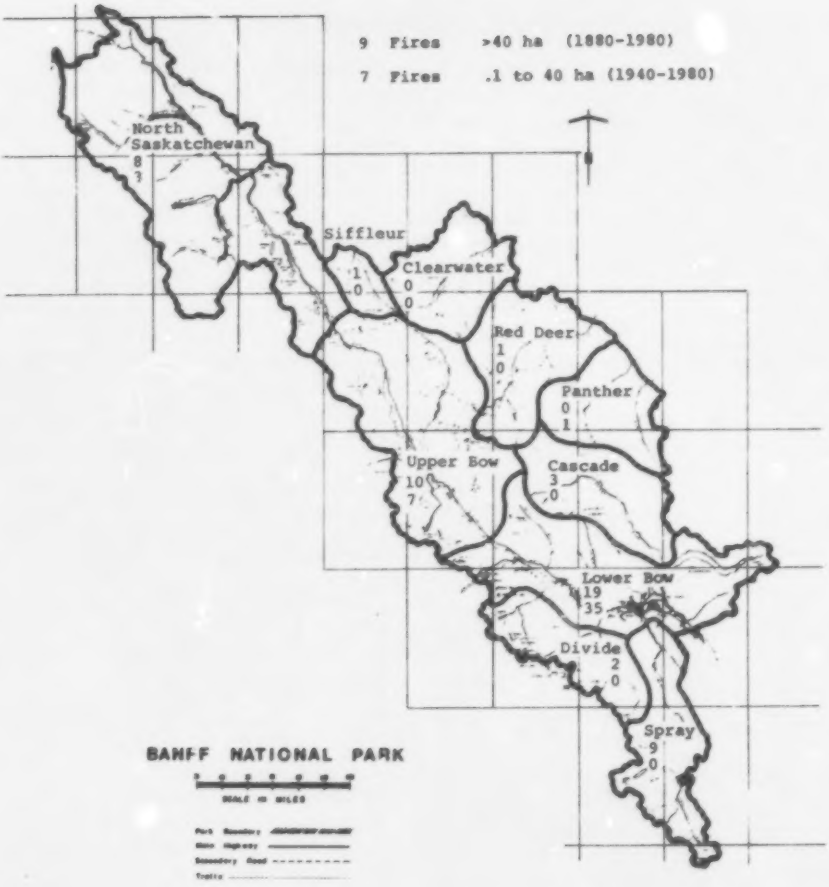


Fig. 28. Number of Banff National Park fires by fire management unit.

montane areas reflects a climate more favourable for burning than the subalpine (Tande 1977; Hawkes 1979) and heavier human use.

On the basis of fire management units the lower and upper Bow Valley areas have experienced the most fires (over 40 ha) since 1880 (Fig. 28) — undoubtedly due to high human use (railroad, towns, etc.). The North Saskatchewan area may be fire prone due to a large and dry montane zone. The Spray area has also had relatively heavy human use. The four fire management units along the eastern part of the park (Panther, Red Deer, Clearwater, and Siffleur) have had few fires greater than 40 ha

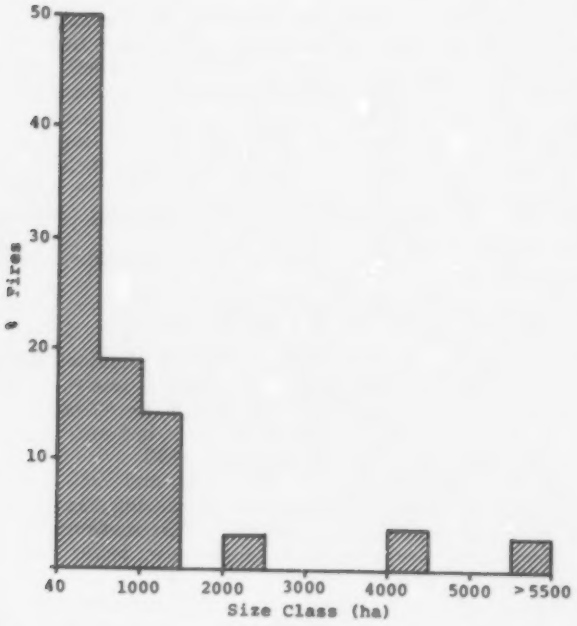


Fig. 29. Montane fires (>40 ha) broken down by size class.

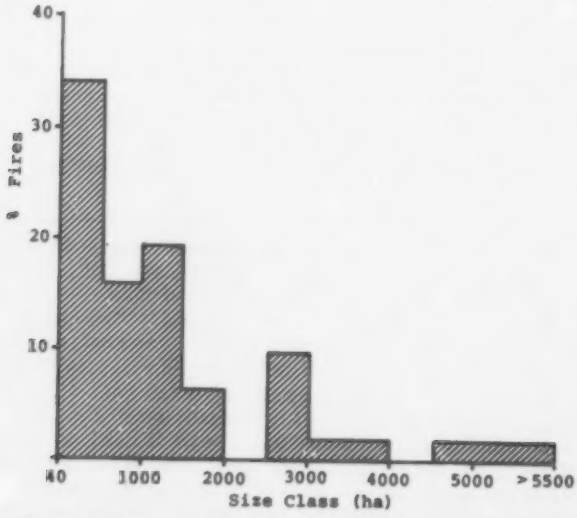


Fig. 30. Subalpine fires (>40 ha) broken down by size class.

since 1880, probably due to small areas below 2130 m and light human use.

Fire sizes tend to be larger in subalpine areas (mean fire size 1646 ha) in comparison with montane fires (mean fire size 1234 ha). As Figures 29 and 30 show, many fires in both the montane and subalpine are between 40 and 500 ha, with over 50% of montane fires being less than 500 ha. Larger fires in subalpine areas probably occur due to larger expanses of continuous forest which burn under drier conditions than montane fires (see Precipitation and Fire). Although smaller fires are more common, much of the area burned since 1880 occurred during infrequent fires greater than 1000 ha.

Area Burned and Number of Fires by Decade

The area burned per decade (Table 13) has declined sharply from approximately 40 000 ha in the 1880s and 1890s to less than 500 ha since 1950. Assuming that the number of large fires (over 40 ha) between 1880 and 1899 is underestimated, the number of fires has also decreased from over 10 fires per decade to 1 fire or less since 1950.

Time-since-fire calculated as of 1880, 1930, and 1980 for fire history sample plots provides further evidence of decreasing fire activity. Figures 31-34 show time-since-fire frequency distributions for warm-dry montane, warm-dry lower subalpine, cool-moist lower subalpine, and upper subalpine sample plots.

Due to decreased fire frequency, the mean time-since-fire increased for all forest groups. For example, in warm-dry lower subalpine forests the average time-since-fire increased from approximately 85 years in 1880 to 130 years in 1980. The time-since-fire frequency distributions for each group of sample plots shows substantially fewer stands as of 1980 in the recently burned (0-39 years) time-since-fire classes compared with 1930 and 1980. The low occurrence of fire, particularly since 1930, has caused a dramatic shift in stand age structure from 1880 conditions.

Several researchers have maintained that the period near the turn of

Table 13. Burned and number of fires (>40 ha) per decade (1880-1980)

Decade	Area burned (ha)	Number fires	Average fire size (ha)
1880-89	37 050	>6	-
1890-99	18 600	10	1860
1900-09	16 850	12	1404
1910-19	3 300	6	550
1920-29	10 500	9	1167
1930-39	8 050	6	1342
1940-49	4 200	2	2100
1950-59	0	0	0
1960-69	500	1	500
1970-79	45	1	45
TOTALS	99 095	53	

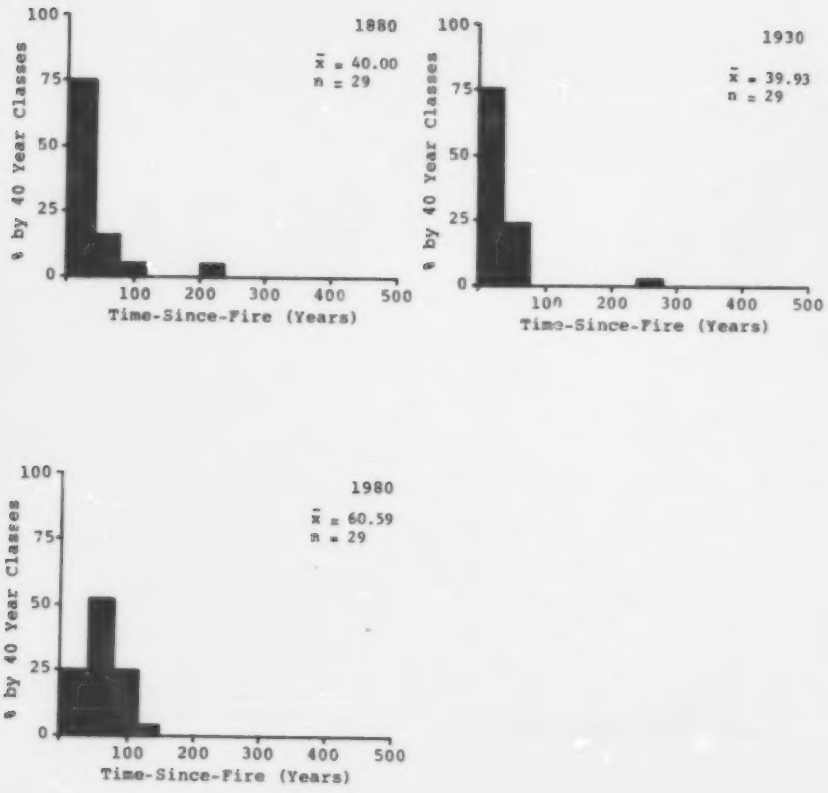


Fig. 31. Time-since-fire distributions for dry montane sample plots as of 1880, 1930, and 1980.

the century was one of exceptionally high fire activity in the Canadian Rockies (Byrne 1964; Mackenzie 1973). The time-since-fire distributions cannot support this assertion. Despite the many fires in Banff Park from 1880 to 1930, the percentage of stands in the short time-since-fire classes did not increase between 1880 and 1930. In fact, increasing means of time-since-fire as of 1930 compared with 1880 for most forests indicate that fire activity may have decreased slightly from 1880 to 1930. For example, the mean time-since-fire in cool-moist subalpine forests rose from 128 years in 1880 to nearly 160 years by 1930. Thus the many man-caused fires after 1880 only partially maintained a situation that existed prior to that time. Tande (1977) found a similar situation of no dramatic increase in fire activity during the late 1800s and early 1900s for the Jasper area.

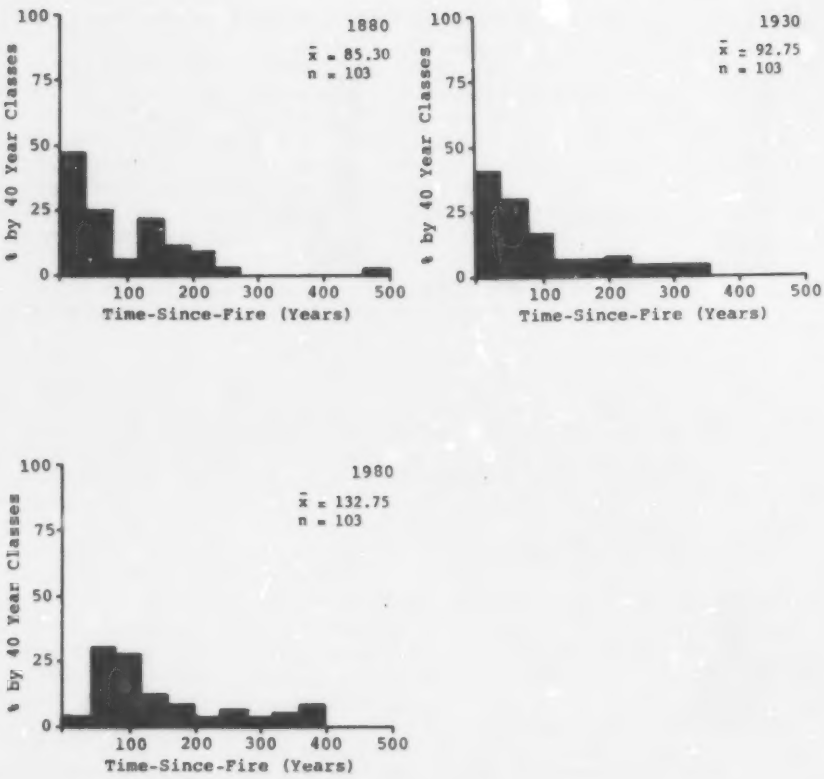


Fig. 32. Time-since-fire distributions for dry-warm lower subalpine sample plots as of 1880, 1930, and 1980.

The cause of the decrease in burned area per decade since 1900 lies in a combination of factors, including ignition sources, climate, and effects of fire control. These are discussed in the following sections.

Ignition Sources

Little information exists on ignition sources of large fires (over 40 ha); however, Tables 14 and 15 provide approximate statistics for the number of fires and burned area by ignition source. Man-caused large fires are the most significant in terms of number and area burned, with the railroad and park visitors (fishermen, campers, etc.) being the principle sources. Probably many of the large fires from 1880 to 1889 that have unknown

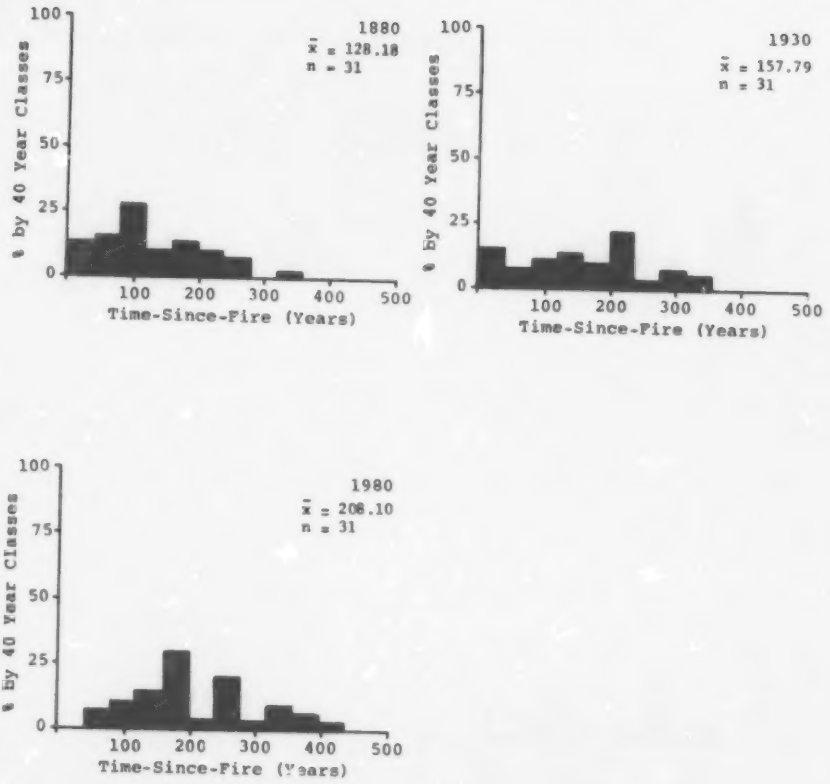


Fig. 33. Time-since-fire distributions for moist-cool lower subalpine sample plots as of 1880, 1930, and 1980.

ignition sources were also related to railway construction; this would further increase the percentage of man-burned area since 1880. In addition, small fires (0.1-40 ha) were started much more frequently by man than by lightning from 1940 to 1980 (Table 15).

The prevalence of man-started over lightning fires since 1880 is easily explained. The Banff area has a low lightning occurrence in comparison with more southerly Rocky Mountain areas (Shroeder and Buck 1970). Rain accompanies most thunderstorms in the Banff area and moist higher elevation areas are the most lightning prone. In contrast, man's activities are often greatest during periods of fair weather and are most concentrated in the dry valley bottoms. Sparks from the wood- and coal-burning railroad locomotives used before 1960 caused many fires. In recent years tie burning and track grinding have continued to start fires along the

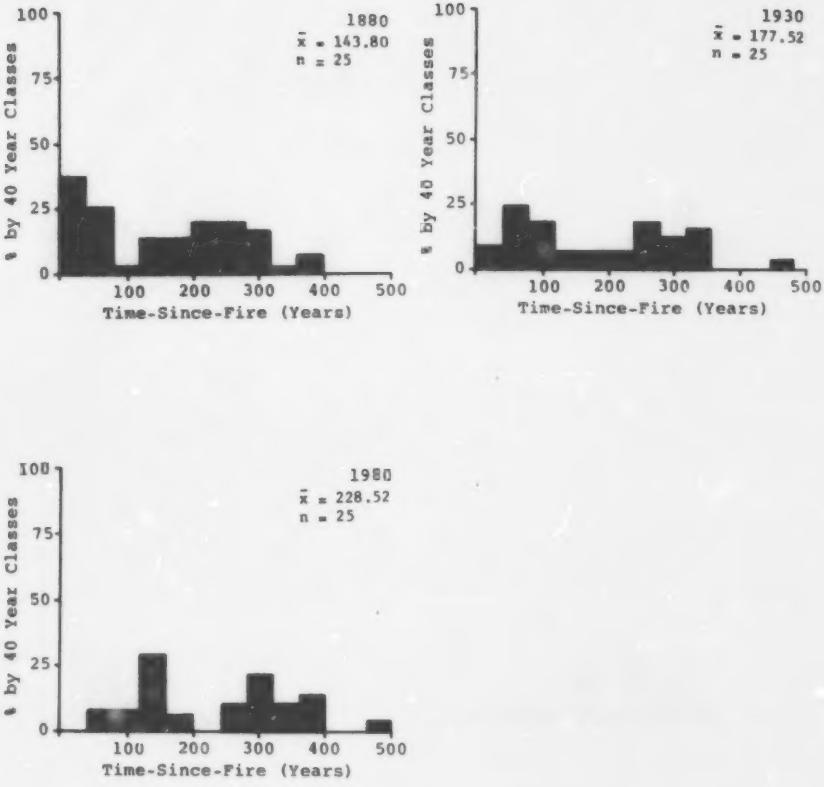


Fig. 34. Time-since-fire distributions for upper subalpine sample plots as of 1880, 1930, and 1980.

right-of-way. The use of Banff's backcountry by fishermen and outfitters appears to have started some large fires before 1940. Slash burning during construction projects such as the Minnewanka power project and the Trans Canada Highway ignited additional forest fires.

The predominance of man-caused fires since 1880, and the fact that even with all the fires started the burned area has actually decreased, suggest that man-caused fire was also very important prior to 1880. This may be further evidence that aboriginal man was an important source of fires in the Banff area before 1880 (see Before 1880).

Given that man-started fires have probably long contributed the major portion of Banff's burned area, the decrease in burned area in the last 40 years may be mostly due to effective fire prevention. The shift from coal-fired engines to diesel power on the railroad sharply reduced the

Table 14. Number of fires (>40 ha) and area burned by ignition source (1880–1980)

	Number of fires	Area burned
Recreation	8	10 350
Settlement	3	11 100
Woods operation	2	200
Railroads	11	12 900
Other industry	2	2 100
Incendiaries	0	0
Lightning	7	15 400
Unknown	20	46 845
TOTAL	53	99 095
TOTAL MAN-STARTED	26	36 850

Table 15. Number of fires (0.1–40 ha) by ignition source (1940–80)

	Number of fires	%
Recreation	8	17
Settlement	1	2
Woods operation	0	0
Railroads	17	39
Other industries	1	1.5
Incendiaries	1	1.5
Miscellaneous man-started	12	26
Lightning	4	8
Unknown	3	6
TOTAL	47	100
TOTAL MAN-STARTED	40	85

number of fires. Furthermore, today's park visitors appear to be more cautious with fire than those in the past probably as a result of fire prevention advertising campaigns. As a measure of fire prevention success, the ratio of known man-caused fires to lightning fires was 25:6 from 1880 to 1940, and after 1940 dropped to 1:1 (for fires over 40 ha). Assuming that the frequency of lightning fires has remained relatively constant, this illustrates a sharp decrease in man-caused fires.

Precipitation and Fire

Precipitation is an important factor influencing fire activity in BNP. Ordinating the years 1890 to 1980 on the basis of spring (1 April to

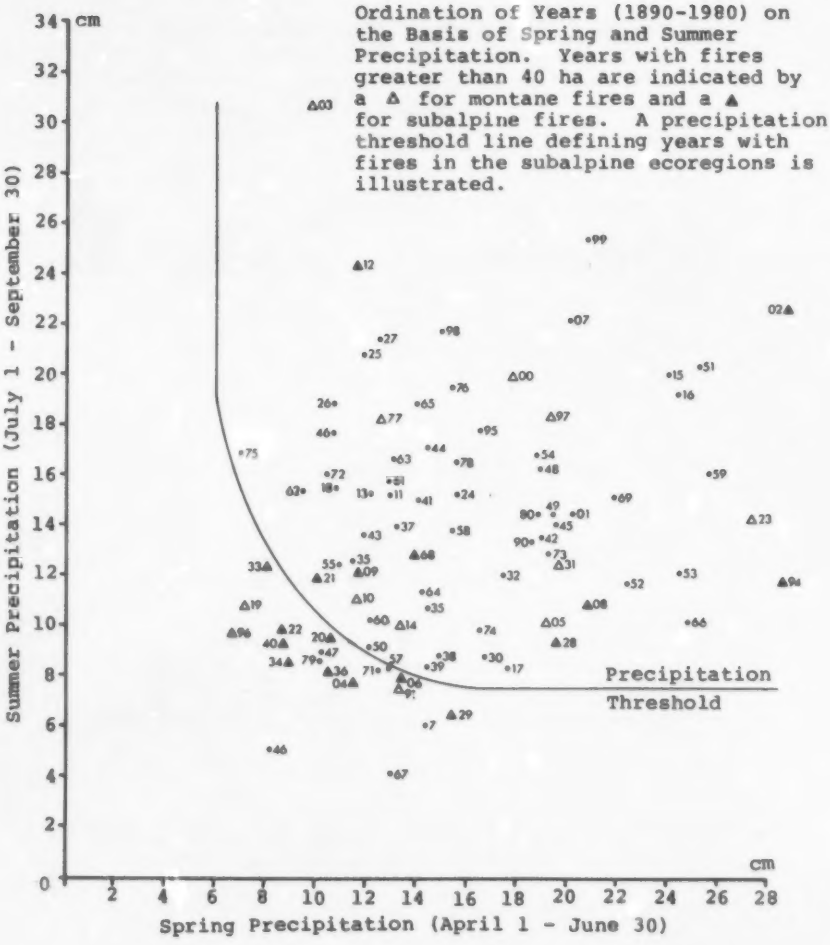

Ordination of Years (1890-1980) on the Basis of Spring and Summer Precipitation. Years with fires greater than 40 ha are indicated by a Δ for montane fires and a ▲ for subalpine fires. A precipitation threshold line defining years with fires in the subalpine ecoregions is illustrated.
Summer Precipitation (July 1 - September 30)
Spring Precipitation (April 1 - June 30)
cm
Precipitation Threshold

Fig. 35. Ordination of years (1890-1980) on the basis of spring and summer precipitation.

30 June) and summer (1 July to 30 September), precipitation for the Banff townsite station (Fig. 35) accentuates the link between precipitation and fire. A threshold line is shown on the graph below which there is a high probability of a large fire occurring. Before 1941, 12 out of 13 years (92%) that had precipitation below the threshold had fires greater than 40 ha. The hyperbolic curve of the threshold line is theoretically valid. Extremely dry spring quarters (less than 6 cm precipitation) should result

in fires, independent of precipitation received later in the summer (e.g. 1919, 1933). Similarly, very dry summers (less than 8 cm) tend to offset any spring precipitation effects and will favour fire occurrence (e.g. 1929). Above threshold years with large fires are usually easy to explain. For example, two fires in 1908 and 1928 ironically both burned on the southwest-facing slopes of Goat Range above the Spray Valley. This area is distinctly dry with an almost montane environment. The 1968 Vermilion Pass fire was preceded by the dryest summer on record in 1967, and a low winter precipitation (Fig. 26).

In addition, most fire years in the montane zone (e.g. 1897, 1900, 1903, 1910, 1912, 1923, 1931, 1977) are not strongly related to seasonal precipitation. Montane fires often spread through cured grasses that take little time to dry out. In contrast, subalpine fire is more dependent on long-term drying of the duff layers on the forest floor.

Spring precipitation appears very important to fire activity. Given that many of these fires did not occur until after 30 June the value of using spring precipitation to predict fires later in the summer is obvious.

Assuming that a precipitation threshold line as indicated in Figure 35 for the Banff station delimits years with potential for large fires, the hypothesis that the decline in area burned since 1940 is partially the result of increased precipitation can be evaluated. Table 16 shows the occurrence of years with below threshold precipitation and major fires (over 40 ha). From 1891 to 1940, there were 12 years with below threshold precipitation for a probability occurrence of 0.24 per year. From 1941 through 1980 there were 7 dry years with a probability of occurrence dropping to 0.174 per year. This is probably not a significant decrease in the frequency of dry years. Thus, a change of climate does not appear to have been an important factor in the decline of BNP fire activity. In fact, consider that before 1941, 12 out of 13 years with below threshold precipitation had large fires whereas after 1941 none of the dry years (e.g. 1946, 1947, 1957, 1967, and 1971) saw large fires in BNP. Evidently, another factor is more important in reducing fire activity. As noted earlier, this is probably the prevention of man-caused fires.

The dry conditions necessary for large fires in Banff Park were often shared by other areas in the Canadian Rockies. The large 1889 Low Bow-Cascade burn was matched by a large fire in Jasper Park the same year. In 1904 both Banff and Yoho had serious fires. Banff's fires of 1908 were occurring at almost the same time as the Elk Valley conflagration. The Saskatchewan Crossing fire of 1910 was small in comparison with other fires in the northern Rocky Mountains that summer. Similarly, the years 1919, 1925, 1929, and 1936 saw large fires both in Banff Park and on adjacent provincial and federal lands. Therefore, BNP's fire suppression planning effort must recognize that during dry fire years little assistance will be available from nearby parks and provincial forests due to fires on their own lands.

Period of Burning

Approximate occurrence dates are known for 39 BNP large fires (over 40 ha) which burned some 60 000 ha. Table 17 and Figure 36

Table 16. Occurrence of years with below threshold spring and summer precipitation at the Banff Station in relation to years with fires>40 ha

Year	Fires >40 ha	Low precipitation	Year	Fires >40 ha	Low precipitation
1890			1935		
1891	X	X	1936	X	X
1892			1937		
1893			1938		
1894	X		1939		
1895					
1896	X	X	1940	X	X
1897	X		1941		
1898			1942		
1899			1943		
			1944		
1900	X		1945		
1901			1946		
1902			1947		X
1903	X		1948		
1904	X	X	1949		
1905	X				
1906	X	X	1950		
1907			1951		
1908	X		1952		
1909	X		1953		
			1954		
1910	X		1955		
1911			1956		X
1912	X		1957		X
1913			1958		
1914	X		1959		
1915					
1916			1960		
1917			1961		
1918			1962		
1919	X	X	1963		
			1964		
1920	X	X	1965		
1921	X		1966		
1922	X	X	1967		X
1923	X		1968	X	
1924			1969		
1925					
1926			1970		X
1927			1971		X
1928	X		1972		
1929	X	X	1973		
			1974		
1930			1975		
1931	X		1976		
1932			1977	X	
1933	X	X	1978		
1934	X	X	1979		X
			1980		

illustrate periods of burning by ecoregion. Apparently the Banff season for larger fires occurs from 15 April through 30 September. Fires in the montane zone occur in the early part of the fire season whereas the lower

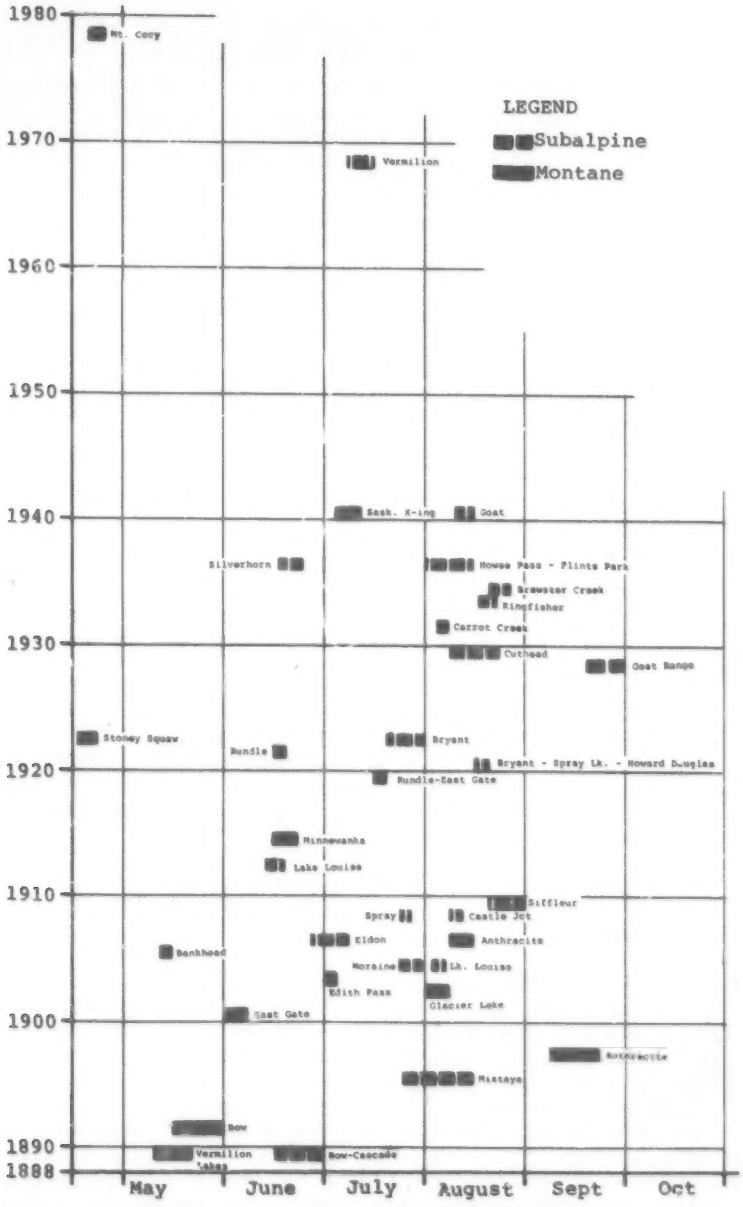


Fig. 36. Known burn periods for fires (>40 ha) in Banff National Park 1888-1930.

Table 17. Period of burning for large fires (>40 ha) in Banff National Park (1880-1980)

Period	No. fires	Total area burned (ha)	Montane area (ha)	Lower subalpine area (ha)	Upper subalpine area (ha)
1-15 April	0				
16-30 April	2	143	130	13	
1-25 May	2	800	600	200	
16-31 May	1	7 500	4 500	3 000	
1-15 June	2	1 250	850	400	
16-30 June	5	13 750	1 100	7 450	5 200
1-15 July	5	6 250	2 750	3 300	200
16-31 July	4	3 800	100	2 850	850
1-15 Aug.	13	17 950	50	11 030	5 970
16-31 Aug.	3	2 800	0	1 730	1 030
1-15 Sept.	1	1 000	1 000	0	0
16-30 Sept.	1	1 700	0	1 000	700
1-15 Oct.	0	0	0	0	0
16-30 Oct.	0	0	0	0	0
TOTAL	39	56 945	11 980	30 995	13 970

subalpine is more fire prone in July and August, with the most active period from 1 to 15 August. Upper subalpine areas also tend to burn in August, except for 5200 ha that burned during the Lower Bow-Cascade fire of June 1889.

The occurrence dates of small fires (0.1-40 ha) are shown in Figure 37. Montane small fires appear to occur earlier in the season and later in the year than subalpine fires.

The outbreak of montane fires before subalpine fires is the result of earlier snow melt and drier conditions at the lower elevations. As noted earlier, montane fires often spread through cured grasses, which are most abundant in spring before green up.

Direction of Burn

Apparent from the burn location maps (Figs. 8, 9, 11, 15, 17, 20, 23) is the easterly burn direction of almost all fires, and the effects of the mountain topography in channelling fire movement. A notable factor in several fires' behaviour appears to be a strong south wind, which resulted in oblong fire paths oriented in a northeast direction. Examples include the Low Bow-Cascade burn of 1889, the Upper Spray fire in 1894 (or 1893), the 1921 Red Deer River fire, and the 1928 Goat Range burn in the Spray Valley.

An eastward direction of burn resulted in at least five fires leaving the park across the eastern boundary into Alberta. Another five fires burned into the park from British Columbia over passes on the Continental Divide.

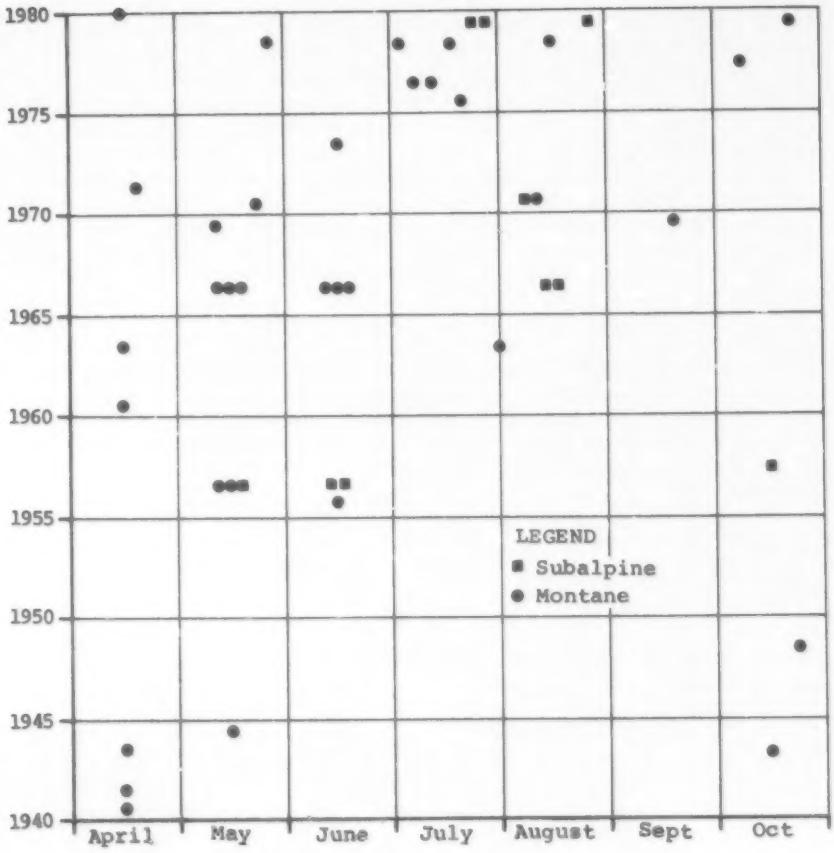


Fig. 37. Known burn periods for fires (0.1-40 ha) in Banff National Park 1940-80.

Results of Fire Control Efforts

Banff Park has attempted to control fires for over 70 years using fire prevention, detection, and suppression techniques. The results of this work are not easily ascertained because it is not known how many fires were prevented, or how large actual fires would have become without suppression action. Accounts of fighting several of the larger fires note that cooler and wetter weather conditions helped stop many blazes. The equipment and manpower available through most of the period must have precluded effective detection and suppression of many fires. Also, as a indicator of relative unimportance of firefighting operations in reducing

fire activity, consider the number of small fires (.1 to 40 ha) that have required fire suppression outside of the Bow and North Saskatchewan highway corridor units (Fig. 28). Since 1940 there has been only one fire in this size class that required suppression in these backcountry areas (Panther River, 8 August, 1971). No fires exceeded 40 ha in Banff's backcountry after 1940. This is striking evidence that it is not the fighting of fires that has reduced the area burned in much of BNP, but rather the prevention of fire occurrence.

Nevertheless, with the beginning of organized fire control efforts in 1909 the number of large fires in the Bow Valley greatly decreased, despite the continued hign risk of ignition from the railroad and numerous park visitors. In more remote areas such as up the Cascade and in the North Saskatchewan Valley large fires continued to occur up to 1940, possibly due to difficulties of detection and access. Recently, quick detection due to reports from park visitors and air patrols and the use of modern initial attack methods (helicopters, etc.) has undoubtedly continued to extinguish fires before large areas are burned in the Bow Valley. Maintenance of firefighting capability in this area is essential because man-caused fires (particularly from the railroad and park visitors) continue to occur.

As noted earlier, prevention of man-started fires is probably the most effective component of BNP's fire control efforts. Prevention of these fires has sharply reduced the burned area per decade in BNP.

Threats to Public Safety, Park Facilities, and Provincial Lands by Random Ignition Fire

The 52 historic BNP fires (over 40 ha) analysed by this report provide an excellent data base to evaluate the potential threats of future random ignition (accidental human- and lightning-started) fires to public safety and facilities in the Banff Park area. These are discussed on a fire management unit (Fig. 28) basis.

Lower Bow

All of the 19 historic random ignition fires located in this area would be considered a serious threat to current park facilities and visitors. It takes little imagination to picture the catastrophic results should any of the 1881, 1891, 1905, 1906, 1908, or 1923 fires be repeated during a busy summer. Today's array of campgrounds, picnic areas, roadways and outlying motels, etc., ensures that virtually any random ignition fire that gains any headway will cause problems. Areas of special concern include the Mt. Norquay and Sulphur Mtn. areas where heavily used park facilities are located on steep wooded hillsides above areas where accidental human ignition is probable. In addition, the location of Tunnel Mountain and Two Jack Campgrounds in the fire-prone montane zone makes the possibility of a serious fire in their areas worthy of consideration.

Upper Bow

Except for the 1896 Molar Creek fire on the Pipestone, all the historic fires located in the upper Bow Valley would have costly outcomes if they reoccurred today. Burns similar to those of 1881 or 1896 which swept up the side of Whitehorn would trap summer visitors on the gondola. Although buildings and clustered developments could probably be spared burning if conflagrations such as those of 1881 or 1885 were to reoccur, telephone and power lines and campgrounds (such as Protection Mountain) would be hard to protect.

Spray

Although the reoccurrence of any of the eight fires in the Spray Valley would not damage any major facilities today, at least three of the fires would cross the park boundary into Alberta's Kananaskis Country. The 1908, 1928, and 1940 burns on the Goat Range caused some uneasiness to Banff residents as they spread northwards in the town's direction; but this uneasiness would be mild compared with today's reaction to a repetition of events. Given the continued development in Kananaskis Country and the possibility of a fire reaching Banff, random ignition fires should be aggressively controlled in the Spray Valley.

Divide

Neither of the two historic burns that began in this area would have burned any of today's facilities. However, the 1934 Brewster Creek fire could have easily escaped the valley and advanced towards Banff. A repetition of the 1881 burn which spread from the Bow Valley up Healy Creek would damage Sunshine Village's gondola, power line, and phone line. Removal of tree cover in the valley would aggravate an already serious avalanche control problem on the public access road.

Cascade

Despite the closeness to the Bow Valley, neither of the two large fires that began in Cascade Valley (1929, 1936) would have seriously threatened any of today's facilities due to direction of burn and mountain ridges preventing passage onto provincial lands. Additional fires such as those of 1881, 1889, and 1905, that spread out of the Bow into the Cascade, continued to burn northwards and would not have threatened current developments.

Panther, Red Deer, and Siffleur

The 1909 Siffleur fire ran virtually to today's park boundary. The 1921 Red Deer burn and a fire in approximately 1876 in the Panther watershed

both advanced to within 5 km of Alberta provincial lands. Thus, although no park facilities would be threatened by repeats of these random ignition fires, a definite threat to provincial lands does exist. A possible break to these fires are white spruce stands near the boundary in both the Panther and Red Deer valleys which appear to have low flammability and have blocked several fires from proceeding eastward. The extent, fire history, and environmental factors of these spruce stands require further investigation.

North Saskatchewan

Of the North Saskatchewan fires, the 1896, 1910, and 1940 burns all swept over or near the site of today's visitor service centre, the 1896 and 1936 burns would have threatened Waterfowl Lakes Campground, and a repeat of the 1891 fire would burn over Rampart Creek Campground and the Youth Hostel. The park boundary was crossed by the 1910 burn and almost crossed again in 1940. The possibility of any uncontrolled fires in this area reaching the Saskatchewan Crossing area and from here being pushed out onto provincial land demands caution in fire planning.

Forest fire auto in Banff National Park, ca. 1915.

CONCLUSIONS

The study of wildland fires in Banff Park since 1880 has dated and located approximately 53 fires greater than 40 ha. The analyses of fire location and changes in fire activity over time yielded several important findings:

1) There is a strong tendency for fires to burn in BNP's montane versus subalpine ecoregions. On an area basis there have been nearly five times the number of major fires (over 40 ha) in the montane compared with the lower subalpine ecoregion.

2) The area burned and number of fires per decade have decreased continually since 1880, and there is no evidence for increased burning during the European development period compared with pre-1880 conditions. This contradicts the traditional viewpoint and research of Byrne (1964) and Mackenzie (1973), but corresponds with the findings of Tande (1977) in Jasper Park, and Hawkes (1979) for Kananaskis Park.

3) Since 1880 the majority of fires have been started by man, not lightning. However, the actual burned area has decreased, possibly indicating that natives started many fires prior to 1880. Anthropological research by Lewis (1980) and Barrett (1981) supports this assertion.

4) Firefighting efforts do not appear to have been effective enough to explain the dramatic decrease in burned area. Through most of 1880 to 1980, firefighting equipment was relatively primitive and access to backcountry areas was limited. The spread of most large fires was stopped by rainfall — not by firefighters.

5) There is no evidence that a climatic change is responsible for decreased fire activity. The frequency of dry years per decade may have decreased slightly in the last 40 years, but the change was not substantial enough to sharply reduce fire activity.

6) Prevention of man-caused fires is probably the primary cause of reduced fire activity in BNP. Up to 1940, the ratio of known man-caused fires to lightning fires was over 4:1. After 1940, the ratio dropped to 1:1. The number of large fires (over 40 ha) caused by man has been substantially reduced.

7) The study of Banff's historic lightning and accidentally man-caused fires (random ignitions) reveals that in most locations a reoccurrence of these burns would seriously threaten park facilities, public safety, or neighboring lands.

Ultimately, the history of BNP's wildland fires from 1880 to 1980 must be used combined with numerous other factors such as knowledge of ecosystem dynamics to formulate fire management directions for BNP. Although information on fire activity from 1880 to 1980 is only a minor component of the total data-base required, it clearly provides two implications for management. Firstly, man has probably long been the primary cause of BNP fires. The success of fire prevention — not firefighting — has been the major cause of reduced fire activity. Therefore management proposals to allow some random ignition fires to burn as a method of maintaining fire-dependent vegetation will not result in significantly more fire activity. This will be particularly true if

prevention of man-caused fires continues. Secondly, there are very few "safe" locations to allow random ignition fires to burn in BNP. Historic burning patterns show that both the locations and timing of many random ignition fires would conflict with current land use conditions. Both the above management implications suggest that carefully located and timed planned ignition fires will have greater applicability to BNP's situation than random ignition fire.

Finally, one cannot read the history of fires and firefighting in Banff Park without appreciating the dominant impact of wildland fires on the development of the Warden Service and Parks Canada's organization as a whole. If not for forest fires, possibly there would be no Warden Service, Parks Canada preservation policies, or system of access trails and roads in Banff Park as seen today. The tragedies and frights caused by the major fires of the northern Rocky Mountains near the turn of the century may have been a blessing in disguise, for they did much to stimulate the preservation of today's national parks and forest preserves.

Thus the low priority Parks Canada has given to wildland fires in the Rockies in the last decade is ironic. However, an increased awareness of fire's ecological importance has rejuvenated interest, and likely the concern about forest fires will soon return to a predominant position in Parks Canada's management.

APPENDIX A. BANFF NATIONAL PARK VEGETATION TYPES

Closed forest vegetation types described by the Banff National Park ecological land classification (Holland and Coen 1982)

Code	Closed Forest Vegetation Type
C1	Douglas-fir/ hairy wild rye (*Pseudotsuga menziesii/Elymus innovatus*)
C2	White spruce/Fern moss (*Picea glauca/Thuidium abietinum*)
C3	Lodgepole pine/juniper/bearberry (*Pinus contorta/Juniperus communis/ Arctostaphylos uva-ursi*)
C4	White spruce/prickly rose/horsetail (*Picea glauca/Rosa acicularis/Equisetum arvense*)
C5	White spruce-Douglas-fir/feathermoss (*Picea glauca-Pseudotsuga menziesii/ Hylocomium splendens*)
C6	Lodgepole pine/buffaloberry/showy aster (*Pinus contorta/Shepherdia canadensis/Aster conspicuus*)
C8	Black spruce-lodgepole pine/willow/sedge (*Picea mariana-Pinus contorta/Salix myrtillifolia/Carex vaginata*)
C9	Lodgepole pine/dwarf bilberry (*Pinus contorta/Vaccinium caespitosum*)
C10	Lodgepole pine/green alder/feathermoss (*Pinus contorta/Alnus crispa/Hylocomium splendens*)
C11	Lodgepole pine/feathermoss (*Pinus contorta-Picea* spp./*Hylocomium splendens*)
C12	Engelmann spruce-whitebark pine/false azalea (*Picea engelmannii-Pinus albicaulis/Menziesia glabella*)
C13	Engelmann spruce-subalpine fir/feathermoss (*Picea engelmannii-Abies lasiocarpa/Hylocomium splendens*)
C14	Englemann spruce-subalpine fir/false azalea (*Picea engelmannii-Abies lasiocarpa/Menziesia glabella/Vaccinium scoparium*)
C15	Engelmann spruce-subalpine fir/grouseberry (*Picea engelmannii-Abies lasiocarpa/Vaccinium scoparium*)
C16	Aspen/hairy wild rye-peavine (*Populus tremuloides/Elymus innovatus-Lathyrus ochroleucus*)
C17	Balsam poplar/buffaloberry (*Populus balsamifera/Shepherdia can-*

prevention of man-caused fires continues. Secondly, there are very few "safe" locations to allow random ignition fires to burn in BNP. Historic burning patterns show that both the locations and timing of many random ignition fires would conflict with current land use conditions. Both the above management implications suggest that carefully located and timed planned ignition fires will have greater applicability to BNP's situation than random ignition fire.

Finally, one cannot read the history of fires and firefighting in Banff Park without appreciating the dominant impact of wildland fires on the development of the Warden Service and Parks Canada's organization as a whole. If not for forest fires, possibly there would be no Warden Service, Parks Canada preservation policies, or system of access trails and roads in Banff Park as seen today. The tragedies and frights caused by the major fires of the northern Rocky Mountains near the turn of the century may have been a blessing in disguise, for they did much to stimulate the preservation of today's national parks and forest preserves.

Thus the low priority Parks Canada has given to wildland fires in the Rockies in the last decade is ironic. However, an increased awareness of fire's ecological importance has rejuvenated interest, and likely the concern about forest fires will soon return to a predominant position in Parks Canada's management.

APPENDIX A. BANFF NATIONAL PARK VEGETATION TYPES

Closed forest vegetation types described by the Banff National Park ecological land classification (Holland and Coen 1982)

Code	Closed Forest Vegetation Type
C1	Douglas-fir/ hairy wild rye (*Pseudotsuga menziesii/Elymus innovatus*)
C2	White spruce/Fern moss (*Picea glauca/Thuidium abietinum*)
C3	Lodgepole pine/juniper/bearberry (*Pinus contorta/Juniperus communis/ Arctostaphylos uva-ursi*)
C4	White spruce/prickly rose/horsetail (*Picea glauca/Rosa acicularis/Equisetum arvense*)
C5	White spruce-Douglas-fir/feathermoss (*Picea glauca-Pseudotsuga menziesii/ Hylocomium splendens*)
C6	Lodgepole pine/buffaloberry/showy aster (*Pinus contorta/Shepherdia canadensis/Aster conspicuus*)
C8	Black spruce-lodgepole pine/willow/sedge (*Picea mariana-Pinus contorta/Salix myrtillifolia/Carex vaginata*)
C9	Lodgepole pine/dwarf bilberry (*Pinus contorta/Vaccinium caespitosum*)
C10	Lodgepole pine/green alder/feathermoss (*Pinus contorta/Alnus crispa/Hylocomium splendens*)
C11	Lodgepole pine/feathermoss (*Pinus contorta-Picea* spp./*Hylocomium splendens*)
C12	Engelmann spruce-whitebark pine/false azalea (*Picea engelmannii-Pinus albicaulis/Menziesia glabella*)
C13	Engelmann spruce-subalpine fir/feathermoss (*Picea engelmannii-Abies lasiocarpa/Hylocomium splendens*)
C14	Englemann spruce-subalpine fir/false azalea (*Picea engelmannii-Abies lasiocarpa/Menziesia glabella/Vaccinium scoparium*)
C15	Engelmann spruce-subalpine fir/grouseberry (*Picea engelmannii-Abies lasiocarpa/Vaccinium scoparium*)
C16	Aspen/hairy wild rye-peavine (*Populus tremuloides/Elymus innovatus-Lathyrus ochroleucus*)
C17	Balsam poplar/buffaloberry (*Populus balsamifera/Shepherdia can-*

adensis)

C18 Lodgepole pine/buffaloberry/grouseberry *(Pinus contorta/Shepherdia canadensis/Vaccinium scoparium)*

C19 Lodgepole pine/buffaloberry/twinflower *(Pinus contorta/Shepherdia canadensis/Linnaea borealis)*

C20 Lodgepole pine/false azalea/ grouseberry (*Pinus contorta/Menziesia glabella/ Vaccinium scoparium*)

C21 Engelmann spruce-subalpine fir/tall bilberry/liverwort *(Picea engelmannii-Abies lasiocarpa/Vaccinium membranaceum/Barbilophozia lycopodioides)*

C22 Aspen/hairy wild rye-showy aster *(Populus tremuloides/Elymus innovatus-Aster conspicuus)*

C23 Subalpine larch-subalpine fir/ grouseberry-everlasting *(Larix lyallii-Abies lasiocarpa/Vaccinium scoparium-Antennaria lanata)*

C24 Engelmann spruce-subalpine fir/rock willow/white mountain heather *(Picea engelmannii-Abies lasiocarpa/Salix vestita/Cassiope tetragona)*

C26 White spruce/buffaloberry/fern moss *(Picea glauca/Shepherdia canadensis/Thuidium abietinum)*

C27 White spruce/prickly rose/fern moss *(Picea glauca/Rosa acicularis/Thuidium abietinum)*

C28 Balsam poplar/horsetail *(Populus balsamifera/Equisetum pratense)*

C29 Lodgepole pine/Labrador tea *(Pinus contorta/Ledum groenlandicum)*

C30 Engelmann spruce-subalpine fir/Labrador tea/crowberry) *(Picea engelmannii-Abies lasiocarpa/Ledum groenlandicum/Empetrum nigrum)*

C31 Engelmann spruce-subalpine fir/hairy wild rye-heartleaf arnica-twinflower/feathermoss *(Picea engelmannii-Abies lasiocarpa/Elymus innovatus-Arnica cordifolia-Linnaea borealis /Hylocomium splendens)*

C32 Engelmann spruce/horsetail/feathermoss *(Picea engelmannii/Equisetum arvense/Hylocomium splendens)*

C33 Engelmann spruce/hairy wild rye *(Picea engelmannii/Elymus innovatus)*

C34 Engelmann spruce-subalpine fir/heather/feathermoss (*Picea*

engelmannii-Abies lasiocarpa/Phyllodoce glanduliflora/Hylocomium splendens)

C35 Lodgepole pine- (Engelmann spruce)/crowberry/lichen (*Pinus contorta-(Picea engelmannii)/Empetrum nigrum/Cladonia mitis*)

C36 Lodgepole pine-white spruce/willow/hairy wild rye (*Pinus contorta-Picea glauca/Salix glauca/Elymus innovatus*)

C37 White spruce/buffaloberry/feathermoss (*Picea glauca/Shepherdia canadensis/Hylocomium splendens*)

LITERATURE CITED

Alberta Forest Service
1936a. "Individual Fire Report – Galatea fire." Aug. 3-10, 1936. P. Campbell, Ranger.
1936b. "Individual Fire Report – Elk Pass Fire." Late June to Nov. 28, 1936. P. Campbell, Ranger.

Anderson, F.W., and B. O.K. Reeves
1975. Jasper National Park archaeological inventory. Parks Canada Western Regional Office, Calgary, Alta. 200 pp.

Anderson, H.E.
1968. Sundance fire: an analysis of fire phenomena. USDA For. Serv. Res. Pap. INT-56, 37 pp. Intermountain Forest and Range Experiment Station, Ogden, Utah 84401.

Arno, S.F.
1976. The historical role of fire on the Bitterroot National Forest. USDA For. Serv. Res. Pap. INT-187, 29 pp. Intermountain Forest and Range Experiment Station, Ogden, Utah 84401.

Arno, S.F., and K.M. Sneck
1977. A method for determining fire history in coniferous forests of the Mountain West. USDA For. Serv. Gen. Tech. Rep. INT-42, 28 pp. Intermountain Forest and Range Experiment Station, Ogden, Utah 84401.

Barneby, W.
1889. The new far west and the old far east. Edward Stanford, London.

Barrett, S.W.
1981. "Relationship of Indian-caused fires to the ecology of Western Montana forests." M.Sc. thesis, Univ. of Montana, Missoula. 198 pp.

Bone, P.T.
1947. When the steel went through. Reminiscences of a railroad pioneer. The MacMillan Company of Canada, Toronto, Ont. 180 pp.

British Columbia Forest Service
1936. Final Fire Report – Quarrie fire, Kootenay Land District. June 14-Aug. 1. H.E. Couillard, Patrolman.

Brown, A.A., and K.P. Davis
1973. Forest fire: control and use. Ed. 2, 686 pp. McGraw-Hill, New York.

Byrne, A.R.
1964. "Man and landscape change in the Banff National Park area before 1911." M.A. thesis, Univ. Calgary, Alta. 173 pp. (Also published as

Studies in Land Use History and Landscape Changes, Natl. Park Series No. 1, 1968.)

Carleton, E.C.
1961. "Forest fires in Rocky Mountains (Banff) National Park." Unpublished mimeo. Banff National Park Warden Service, Banff, Alta. 12 pp.

Cheadle, W.B.
1865. Dr. Cheadle's journal of trip across Canada, 1862-1863. M.G. Hurtig, Edmonton, Alta. 311 pp.

Chief Park Warden Reports
1964-68. Chief Park Warden Reports. Banff National Park, Administration Building, Banff, Alta.

Christenson, O.A.
1971. Banff prehistory: prehistoric settlement and subsistence in Banff National Park, Alberta. Manuscript Report No. 67. National Historic Parks and Sites Branch, Ottawa, Ont. 279 pp.

Coleman, A.P.
1911. The Canadian Rockies – new and old trails. Henry Frowde Publisher, Toronto, Ont.

Damp, J.E., C.E. Connolly, and T.V. Smith
1980. Conservation archaeological studies at EhPw-2 and EhPw-4, Banff National Park. Lifeways of Canada Ltd. Consultant report for Parks Canada Western Regional Office, Calgary, Alta. 139 pp.

Day, R.J.
1972. "Stand structure, succession, and use in southern Alberta's Rocky Mountain Forest." Ecology 53: 472-78.

Department of the Interior
1888-1934. Annual Reports of the superintendent of Rocky Mountains Park. Ottawa, Ont.

Gabriel, H.W. III
1976. "Wilderness ecology: the Danaher Creek Drainage, Bob Marshal Wilderness, Montana." Ph.D. thesis, Univ. of Montana, Missoula. 224 pp.

Hamer, D., and S. Herrero
1983. "Ecological studies of the grizzly bear in Banff National Park – final report. Univ. of Calgary, Calgary, Alta. 263 pp.

Hawkes, B.C.
1979. "Fire history and fuel appraisal of Kananaskis Provincial Park, Alberta." M. Sc. thesis, Univ. of Alberta, Edmonton. 172 pp.

Holbrook, S.H.
1943. Burning an empire. The MacMillan Company, New York.

Holland, W.D., and G.M. Coen, general editors
1982. Ecological land classification of Banff and Jasper National Parks. Alta. Inst. Ped. Publ. M-83-2. 3 vols. + maps.

Horton, K.W.
1956. The ecology of lodgepole pine in Alberta and its role in forest succession. Department of Northern Affairs and Water Research, Forest Branch. For. Res. Tech. Note No. 45. 29 pp.

Janz, B., and D. Storr
1977. The climate of the contiguous mountain parks. Atm. Env. Serv. Proj. Rep. No. 30. 324 pp. Toronto, Ont.

Leavitt, C.
1915. Forest protection in Canada 1913-1914. Commission of Conservation Canada. William Briggs, Toronto, Ont.

Lewis, H.T.
1980. "Indian fires of spring." Nat. Hist. 89(1): 76-81.

Lopoukhine, N., and C. White
1983. "Fire Management Options in Canada's National Parks." Proceedings Intermountain Fire Council Workshop, Banff, Alberta.

MacKenzie, G.A.
1973. "The fire ecology of the forests of Waterton Lakes National Park." M. Sc. thesis, Univ. of Calgary, Alta. 199 pp.

Mair, W.W.
1952. "The impact of an introduced population of elk on the biota of Banff National Park." M. Sc. thesis, Univ. of British Columbia, Vancouver.

Marsh, A.H.
1979. "Fire history of the Cuthead region, Banff National Park." Draft report. Department of Environmental Design, Univ. of Calgary, Alta. 29 pp.

Miles, T.W., and J.S. Bland
1974. Forest fire danger charts and weather records. Can. For. Serv. Misc. Rep. FF-Y-3. Forest Fire Research Institute, Ottawa, Ontario. 7 pp.

Nelson, J.G., and A.R. Byrne
1966. "Fires, floods and national parks in the Bow Valley, Alberta." Geog. Rev. 56: 226-38.

North, F.K., and G.L. Henderson
1954. "Summary of the geology of the southern Rocky Mountains of Canada." In Guidebook, Fourth Annual Field Conference, Alberta Society of Petroleum Geologists. pp. 15-81.

Patterson, R.M.
1961. The buffalo head. The MacMillan Company of Canada, Toronto, Ont. 237 pp.

Reeves, B.O.K.
1974. "Prehistoric archaeological research on the eastern slopes of the Canadian Rockies 1967-1971." Can. Arch. Assoc. Bull. 6: 1-31.

Ritchie, H.
ca. 1915. "Causes of floods in previous years as compared to last few years and what effect of reforestation on stream flow as well as burning of forest." Incomplete Report. Irrigation Office, Dept. of Interior. 4 pp.

Rogers, G.
1969. "Kootenay-Banff Fire Board of Review." Parks Canada Western Regional Office, Calgary, Alta. 32 pp. and append.

Shroeder, M.J., and C.C. Buck
1970. Fire weather – a guide for application of meteorological information to forest fire control operations. USDA Agric. Handb. 360, 229 pp. Washington, D.C.

Sime, J.A.
1969. "Role of the warden service." Minutes of the Annual Supt. Conference, Banff National Park Files. 16 pp.

Stutfield, H.E.M., and J.N. Collie
1903. Climbs and explorations in the Canadian Rockies. Longmans, Green and Company, New York and Bombay. 343 pp.

Superintendent Reports
1941-80. Superintendent Reports. Banff National Park, Administration Building, Banff, Alta.

Tande, G.F.
1977. "Forest fire history around Jasper townsite, Jasper National Park, Alberta." M.Sc. thesis, Dept. of Botany, Univ. of Alberta, Edmonton, Alta.

1979. "Fire history and vegetation pattern of coniferous forests in Jasper National Park, Alberta." Can. J. Bot. 57: 1912-31.

Van Kirk, S.M.
1969. "The development of national park policy in Canada's mountain national parks." M.A. thesis, Univ. of Alberta, Edmonton, Alta.

Van Wagner, C.E.
1974. Structure of the Canadian Forest Fire Index. Dept. Env. Can. For. Serv. Publ. 1333. Ottawa, Ont. 44 pp.
1978. Age-class distribution and the forest fire cycle. Can. J. For. Res. 8: 220-27.

White, C.A.
1984. "Fire and biomass in Banff National Park forests." Draft final report. Banff National Park Warden Service, Banff, Alta. 179 pp.

Wilcox, W.D.
1900. The Rockies of Canada. G.P. Putnam's Sons, New York. 309 pp.

Williams, M.B.
1936. Guardians of the wild. T. Nelson and Sons Ltd., Toronto. 148 pp.

Wilson, T.E.
1972. Trail blazer of the Canadian Rockies. H.A. Dempsey ed. Historical Paper No. 3, Glenbow-Alberta Institute, Calgary, Alta. 54 pp.

Yoho National Park Warden Service
1974. "Forest fire history maps for Yoho National Park." Unpublished data, Field, B.C.